Improving the Performance of Full-service Retail Seafood Departments

Michael G. Haby
Russell J. Miget
Thomas E. Rippen
Charles W. Coale Jr.

Sea Grant
A Texas Sea Grant College Program Publication

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For information about Texas Sea Grant College Program publications, contact:
Marine Information Service
Texas Sea Grant College Program
1716 Briarcrest, Suite 603
College Station, Texas 77802

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PREFACE

Expectations of Research-based Standard Operating Procedures

This book presents the results of an applied research effort that can be used to improve economic performance from full service seafood departments and reduce the opportunities for otherwise wholesome ready-to-eat products to become unsafe. Improved economic performance occurs when a portion of chronic costs such as shrinkage, that result from accelerated spoilage, are sharply reduced. Although the primary issue within retail seafood operations is how to ensure sustained profitability, as more ready-to-eat foods are prepared and sold through full-service departments, ensuring product safety becomes increasingly important. Shrinkage creates a proportional (limited) expense for the department, but a severe foodborne illness traced to retail negligence can affect the entire corporation.

During retail stewardship, the same handling errors and time/temprature abuses that lead to accelerated spoilage across the raw product line also threaten the safety of ready-to-eat foods. Preventing these errors requires a structured approach. Standard operating procedures (SOPs) are outlined for each function customarily found within retail seafood departments. These SOPs improve current in-store handling and holding routines that are partially responsible for the rapid consumption of remaining shelf life that leads to additional shrinkage expense and customer disappointment. Simultaneously, they prevent compromises to the safety of ready-to-eat seafood products. In addition, the SOPs are easily understandable by those who must complete them, and time-efficient to carry out since employees are responsible for other duties besides ensuring quality and safety.

The Limitations of Improved In-store Procedures

All perishable muscle products begin to deteriorate upon death, so improving a given product is impossible. However, preventing handling and holding errors will give the grocer more time to sell the product and provide consumers fresher, more enjoyable seafood meals.

These SOPs represent a set of best management practices. Being able to state precisely how products were handled from retail receipt through sale (or discard) can help establish responsibility for accelerated spoilage at points upstream of the retailer (i.e., fisherman, processor or wholesaler). Such precision is important because the width of the seafood product line is vast, comprising several hundred commercially marketed products. When numerous processors and mid-level handlers are factored into the product line, literally thousands of product and purveyor combinations are created. Although grocers may receive the same store keeping unit (SKU) each week, through time that particular SKU may have been produced, processed and handled by different combinations of entities. At some point all retailers have been faced with an SKU that meets sensory requirements upon receipt, yet must be discarded within a few days' time. The SOPs outlined in this text will have no positive effect on such items, although they will serve to isolate one SKU from another thus reducing widespread premature spoilage. When confronted with this situation, the manager may feel that the SOPs presented here have questionable value. However, adopting these SOPs will enable the grocer to work with distributors cooperatively to solve the riddle of rapid consumption of shelf life. It may require that the distributor upgrade his specifications that, in turn, makes his suppliers upgrade theirs.

What Impact Will New Federal Seafood Safety Rules Have on Retail Operations?

Applied research that resulted in this text began in the mid-eighties, far ahead of the "Seafood HACCP Regulation." The new regulatory oversight created by the FDA's HACCP regulation requires seafood processors — not fishermen or retailers — to implement sanitation standard operating procedures. These procedures ensure that the Good Manufacturing Practices are being followed. Further, those firms that process species with identifiable biological, chemical or physical hazards must control them with a HACCP-based system custom tailored by species and type of processing. HAACP-based systems build a higher margin of safety into products by (a) enumerating the hazards associated with a particular species and the manner in which it is processed, (b) determining points in the process where safety can be lost (i.e., critical control points or CCPs), (c) establishing minimum requirements at each CCP that must be met to control the identified hazard(s), and (d) monitoring various parameters at each CCP to ensure that predefined limits are met.

Some may think that this regulation will shift most of the burden for ensuring seafood quality and safety to the processor, and reduce the importance of these functions within retail operations. Ironically, retailers must become even more committed to quality and safety management because of several, interrelated reasons. First, even though universal sanitation standard operating procedures will slightly improve the shelf life of some refrigerated products, supermarkets will continue to receive a mix of seafood products, each with a bacterial load (and thus a shelf life) that is different from all others. Therefore, preventing contact between different items and ensuring constant, cold product temperatures are key steps in sharply reducing avoidable shrinkage costs that result from accelerated spoilarge. Second, the HACCP regulation focuses strictly on ensuring product safety at a specific point in the distribution chain. This creates additional responsibility for grocers because, under HACCP, processors now have a permanent, lot-by-lot record of the precise conditions encountered at each CCP in their process. Should a food-borne illness occur, processing records can now be scrutinized to determine whether product safety was compromised during processing or at another point in the marketing chain. Because such monitoring records can be used to fix responsibility or to absolve the processor, retailers must implement defensible procedures that prevent compromises to product safety during their stewardship. Third, an important unexpected result of mandatory HACCP may be that some trade-related, fee-based inspection programs used to ensure standards and specifications will go by the wayside. Thus, even with these new food safety mandates in place for seafood processors, grocers must ensure that merchandise meets predefined specifications and implement research-based SOPs that prevent handling and holding errors during retail stewardship.

How to Use This Book

In preparing this text we wrestled with two mutually exclusive goals: (a) providing a comprehensive treatment of in-store quality and safety management systems and (b) making the reference easily readable. While a rigorous examination of retail seafood operations has been developed, reading this reference "cover-to-cover" may be a daunting challenge. Therefore, sidebars have been added to the body of each chapter (beyond the Introduction) that encapsulate (a) observed handling and holding errors and (b) SOPs that prevent these errors. Most of the detail is lost with this approach, but it enables a reader to skim each chapter and extract the essence from the sidebars, numerous tables, figures and illustrations.

EXECUTIVE SUMMARY

Over the last 14 years, seafood has become one of the fastest growing full service perishables departments. Since 1983, the number of seafood departments has increased about 10 percent each year to the point where roughly 45 percent of the 29,700 supermarkets nationwide offer seafood via full-service formats. Growing consumer acceptance of seafood products and the grocery industry's aggressive investment program in upscale departments has dramatically increased the retail share of the seafood market. This has created a market success for the retail food sector. In 1993, seafood sales generated a $12 billion dollar component of total grocery store sales (about 3 percent).

Despite its consumer appeal however, profitability lags in many seafood operations. This track record makes a compelling argument that demand alone provides no guarantee of profitable operations. To boost departmental profitability (i.e., make a contribution to store overhead), three approaches or combinations can be used: (a) increase departmental sales volume, (b) increase the departmental weighted average gross margin, or (c) reduce departmental costs. Although profitability increases are possible with each option, sluggish growth in the per capita consumption of all meats and the intensely competitive operating conditions in the grocery industry suggest that neither increased sales volumes nor higher gross margins offer much opportunity to meet profitability objectives. The only avenue left is cost control. Some have argued that additional labor savings are possible, but most full service seafood departments are operated by a single individual. During the afternoon and evening shift, the person on duty is often a parttime employee. Thus, substantive reductions in labor cost will be difficult to find and keep "service" in the department.

On the other hand, shrinkage is a direct departmental cost that can be reduced. Shrink is a significant cost across the refrigerated seafood product line and, according to the Food Marketing Institute, accounts for 10 to 15 percent of total departmental sales. Nationwide, seafood shrink represents a $1.2 to $1.8 billion annual cost to the grocery industry. Some shrink is inevitable and unavoidable with a perishable product line since the time required to sell an item may exceed its remaining shelf life. This situation is exacerbated with seafoods because a significant amount of shelf life has been consumed prior to retail receipt. In fact, retailers often exert management control over no more than the last 20 to 25 percent of remaining shelf life (70 to 85 hours for many species). However, some spoilage occurs prematurely during retail stewardship because improper handling procedures and time/temperature abuse accelerate the rate at which shelf life is consumed. Accelerated spoilage is an avoidable cost, thus representing a source of additional profitability to the firm.

One hallmark of contemporary food retailing is the increasing reliance on ready-to-eat foods. Today, most seafood departments include a growing line of such products that are often prepared on-site; for example, seafood salads fabricated from precooked, prepackaged ingredients or shrimp steamed to order. While such items appeal to convenience-conscious shoppers, they simultaneously represent the retail community's greatest potential menace since improperly prepared or inventoried ready-to-eat products may have their safety compromised and can become public health risks. The occurrence of severe food-borne illness is infrequent. However, retail negligence that results in severe food-borne illness represents a disproportionate, potentially staggering cost that can affect the entire corporation. For example, a food-borne illness associated with a three-dollar purchase can cost the firm millions of dollars in litigation, out of court settlements, bad press, etc. With the ready-to-eat product line becoming increasingly important to the grocery industry, ensuring food safety during retail stewardship is an important new managerial function.

Importantly, accelerated spoilage within the raw product line and compromises to the safety of ready-to-eat foods occur because of the same improper handling procedures, the same time/temperature abuses, or combinations of these. (Of course, if products are cooked on-site, this cooking must be thorough, or the product may be rendered unsafe even if post cook handling and holding steps are correct.) To affect sharp reductions in both avoidable shrinkage and compromised food safety, four equally important, interlocking objectives must be achieved simultaneously and continuously during retail stewardship. These objectives are common knowledge among food retailers, and have been for years: (a) use appropriate handling practices so that various contact opportunities among the microbiologically dissimilar product line are minimized, (b) maintain low product temperatures to slow the growth of microorganisms, (c) ensure that products with the least amount of remaining shelf life are positioned to sell first, and (d) control (destroy) microorganisms by periodically cleaning and sanitizing a variety of environmental and food contact surfaces. Because full service operations are predicated on repetitive product handling, meeting these objectives requires improvements in employee skills. In other words, achieving sharp reductions in both avoidable shrinkage and threats to food safety is dependent upon managing what employees do and how they do it. This means that the four interlocking objectives must be "translated" into a set of procedures that precisely define — in stepwise fashion — how to perform each of the various functions or activities that comprise full-service departmental operations. These procedures must answer the question posed by a hypothetical employee: *"What would you have me do differently from what I am now doing?"*

This reference has two primary objectives. First, it explains the effect that improved management of quality can have upon departmental profitability. As a corollary, the text also shows the importance of a predefined, defensible program that ensures food safety across the ready-to-eat product line. Second, it describes a series of research-based, structured, error-proofed, stepwise standard operating procedures (SOPs) designed for each function found in contemporary full-service seafood departments. These SOPs simultaneously and continuously meet the four interlocking objectives just specified. Just as importantly, each SOP can be carried out by unsupervised, part time associates.

This reference manual is the culmination of applied research work completed over several past and present funding cycles by Sea Grant Extension Specialists at Texas A&M, with assistance from Sea Grant Extension Specialists from the Virginia Polytechnic Institute and State University, and the University of Maryland. Written expressly for the top management team within retail food chains, its purpose is to transfer the knowledge base generated over the past 12 years to managers responsible for designing and implementing quality and safety management programs. Its format facilitates (a) rapid implementation of a defensible quality and safety management system thus enabling grocers to minimize liability exposure and negative public relations should challenge arise; (b) sharp reductions in avoidable shrink and the threat of compromised product safety; and (c) an immediate boost in profitability since cost savings from reduced shrink "fall" right to the bottom line.

Each organizational tier of the retail firm has different information needs. Therefore, work is underway to convert the materials embodied in this text into products most useful to those at different levels within the corporation. For example, top management needs the most comprehensive information, embodied in this reference, that describes what is being proposed and why. Moving down through the managerial hierarchy, district or roving market supervisors and market managers in individual stores need a condensed information set focusing on the procedures. This sort of information is useful in mentoring new employees, making compliance checks, etc. Finally, the person behind the counter has specific information needs too, but at the most basic level. Such information is best communicated via video training tapes and posters that highlight precisely how to perform essential procedures. Once these subsequent educational products are completed, a comprehensive training system will be available to the retail community, with the same information available for each different user, but in a form most useful to them.

Authors

Michael G. Haby is the Seafood Marketing Specialist for the Texas Marine Advisory Service, a cooperative effort of the Texas Sea Grant College Program and the Texas Agricultural Extension Service. He also serves as an Associate Professor and Extension Economist for the Texas A&M University Department of Agricultural Economics and is part of the core faculty in the Center for Food Safety within the Institute for Food Science and Engineering.

Russell J. Miget is the Environmental Quality Specialist for the Texas Marine Advisory Service, a cooperative effort of the Texas Sea Grant College Program and the Texas Agricultural Extension Service. He also serves as an Associate Professor and Extension Specialist in the Department of Wildlife and Fisheries Sciences at Texas A&M University, and is part of the core faculty in the Center for Food Safety within the Institute for Food Science and Engineering.

Thomas E. Rippen is a Seafood Technology Specialist for the Maryland Sea Grant Extension Program and Maryland Cooperative Extension at the University of Maryland.

Charles W. Coale, Jr., is a Professor and Extension Economist in the Department of Agricultural and Applied Economics at Virginia Tech.

Chapter 1

INTRODUCTION

Beginning in the mid-seventies, the seafood industry, the food retailing community and the public sector began a large-scale market development project designed to introduce seafood as another meat choice available from the grocery store. Many grocers were skeptical of the projected economic performance of retail seafood programs because of two unresolved issues. The first was market acceptance. Would anticipated sales volumes be sufficient to justify such an addition to existing store formats? The second concern centered on operations management. Even if sales volumes materialized, food retailers recognized that procuring, handling and selling refrigerated, random-weight seafood products via market-style operations required knowledge that few had.

Early consumer responses to seafood sold through retail departments of grocery stores was poor. Questionable market acceptance led to a variety of research that explored customers' attitudes about eating seafood, shopping for it and preparing it at home. In what has now become common knowledge to those involved in retail operations, this research documented that while customers perceived seafood as inherently healthy, tasty and offering menu variety, two factors generally pre-empted routine purchases. First, certain conditions like strong odors and poor eye appeal created negative cues about shopping for seafood. Second, these negative cues were compounded by the customer's own sense of inadequacy toward product assessment, selection, home storage and preparation.

When asked what changes food retailers could make in their operations to present seafood products more positively, consuming interests agreed on four components necessary to make refrigerated seafood an integral part of home menus. They generally preferred larger sized, full service operations. Customers felt the department should be staffed with knowledgeable personnel who could help them overcome selection and preparation anxiety. They also suggested that pertinent point of sale information about selection and preparation was a quick way to gain those competencies with fish products. Finally, shoppers demanded greater assurances of product safety and quality by retailers. Using these consumer specifications as guideposts, retailers embarked upon an aggressive campaign to upgrade and expand seafood departments.

While many retailers were reorienting seafood operations to meet customer needs, the link between diet and health was drawn into sharper focus and consumers were advised to reduce their consumption of fat. Ultimately, the message to lower fat intake created a fundamental change in seafood use and per capita consumption of seafood began to increase. Perhaps the best evidence of this consumption change can be found by reviewing seafood supply trends, a measure of overall market size.

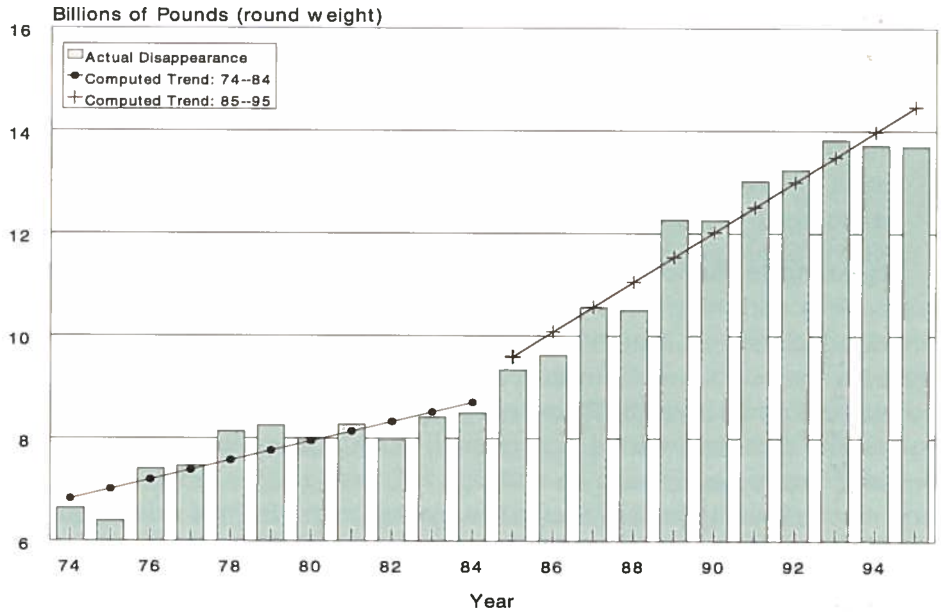

Fig. 1-1. Changes in the U.S. seafood market between 1974 and 1995.

Between 1974 and 1995, the seafood market doubled from 6.6 billion pounds to 13.7 billion pounds.[1] Closer scrutiny shows modest growth between 1974 and 1984, but rapid market expansion between 1985 and 1995 (Figure 1-1). Between 1974 and 1984, the seafood market expanded from 6.8 to 8.7 billion pounds, suggesting that, on average, the market annually grew by roughly 190 million pounds (2.5 percent per annum). However, two-thirds of total market growth occurred between 1985 and 1995. During this time frame, the market jumped from 9.3 to 13.6 billion pounds. The computed trend during this time period shows that the market grew by approximately 425 million pounds each year (4.2 percent per annum).

Despite some initial skepticism about consumer acceptance, grocers have capitalized on a growing seafood market. According to *Progressive Grocer* magazine in its **61st Report to The Grocery Industry**, one in five shoppers "always or frequently" made purchases from service seafood departments (if their store maintained such a department).[2] In 1993, this patronage translated into a $12 billion dollar component of total grocery store sales (about 3 percent).

Although grocers have taken advantage of growing seafood consumption, the retail industry's investment in upscale, full-service departments is in part responsible for market expansion. In 1983, roughly 4,500 stores had service seafood departments.[3] During the next 10 years however, the number of seafood departments in retail food stores grew by roughly 10 percent each year. By 1993, 12,000 supermarkets offered seafood through full service formats.[4]

The diligence of retailers to meet consumer needs coupled with changes in consumption patterns has made seafood an unqualified market success for the grocery industry. With seafoods firmly entrenched within retail operations, grocers need to turn their attention to three significant, inescapable management concerns:

- What must retail management do to convert such a market success into sustained economic performance?
- What can retail management do to minimize (a) the liability threats originating from the preparation and sale of ready-to-eat seafoods and (b) the often staggering economic effects of negative publicity by a more aggressive, opportunistic media?
- How can the firm best ensure that programs, procedures and tasks developed to address the two previous questions are correctly performed by a labor force comprised of a growing proportion of parttime individuals who typically work without direct supervision? In other words, how can management sharply increase the probability that departmental employees consistently do the right things?

Only one pathway can simultaneously address each of these concerns. The grocery industry must adopt comprehensive, research-based quality and safety management programs designed around the operating circumstances found in full service operations that can be carried out by existing, unsupervised personnel. To this end, this text has two primary objectives:

- To provide the retail industry with an in-depth understanding of how improved management of quality and safety can be at the heart of an economically successful full-service seafood program that can also withstand the scrutiny of both regulatory authorities and the media.
- To present research-based retail procedures that continually meet good manufacturing practices and current food safety guidelines while remaining streamlined and simplistic.

This reference is divided into two main parts. Part One introduces the importance of quality and safety management to the firm's most basic goals of maximizing customer demand and profitability while minimizing the avoidable costs of accelerated spoilage, negative public relations, and liability inherent with ready-to-eat foods. Within Part One, Chapter 2 establishes quality and safety as a new, key management function in a full service perishables operation by outlining the role this function can play in addressing profitability, liability, and media scrutiny. Chapter 3 examines the principles necessary to maximize product shelf life and minimize the possibility of compromising the safety of otherwise wholesome ready-to-eat ingredients or products. With the need for a research-based quality and safety management program clearly articulated and an understanding of the principles necessary to meet the objectives of this function, Chapter 4 outlines the approach taken to build such a program.

Part One provides the foundation for Part Two, a series of chapters that addresses each function found in contemporary, full-service seafood departments:

- product display (Chapter 5),

- preparing, packaging, and holding ready-to-eat products like surimi-based seafood salads (Chapter 6),
- custom cooking of shrimp, crawfish, lobsters, crabs, etc. (Chapter 7), and
- cleaning and sanitizing (Chapter 8).

Each of these chapters is organized around the same two major headings. First, observed and potential quality and safety errors are reviewed. Next, a stepwise procedure for correcting these errors is presented. Each chapter in Part Two can stand alone, and should serve as the basis for various training venues.

Two primary themes are woven throughout this manual. First, all recommendations are made under the assumption that future staffing patterns will be similar to those currently in place. Second, improvement is most dependent upon the precise procedures and practices used within retail departments to complete the four primary functions itemized above. Thus, significant detail is provided about what should be done, precisely how to do it, when it should be done, and who should do it. Such detail should not be confused with complexity. In fact, given the *in-absentia* management in most retail departments, effectiveness (correctly doing the right things) is primarily dependent upon efficiency — ensuring that tasks are simple to understand and take little time to complete.

This text strives to improve in-store processes so that accelerated spoilage across the raw product line and public health concerns with ready-to-eat products are both minimized. Therefore, much time has been invested in developing streamlined, error-proofed procedures for each retail function. All involved with this project agree on one point: the design of simplistic, error proofed operating systems is not a simple process. By undertaking this project, all of us have developed a healthy respect for the complexities found within full service departments. Our hope is that the reader can use this text as a point of departure for improving profitability and customer satisfaction while sharply reducing product safety threats.

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3. Ibid.
4. Ibid.

Chapter 2

The Importance of Quality and Safety Management in Full-Service Seafood Departments

Overview

Sustained profitability is particularly challenging in the grocery industry. Retail departments that offer perishable foods through a full-service format present even greater economic challenges because higher costs for spoilage and labor must be recouped. If these costs cannot be reduced, or offset either by higher sales volumes or gross margins, then other portions of the store end up subsidizing unprofitable components.

Despite higher operational costs, full-service perishables departments are a rapidly growing segment of the grocery business because such operations establish a major avenue for meeting new consumer demands for greater conveniences. These conveniences often include a mix of perishable, ready-to-eat foods, some of which are prepared on-site. While such items appeal to convenience-conscious shoppers, they simultaneously represent the retail community's greatest potential menace since improperly prepared or inventoried ready-to-eat products may have their safety compromised and thus become public health risks.

The purpose of this chapter is to outline why a research-based quality and safety management program is the best pathway for simultaneously meeting economic goals and minimizing the liability inherent with ready-to-eat foods. This rationale stems from a detailed review of current retail operating conditions.

Current Operating Conditions Within Seafood Departments

With few barriers to entry, the grocery business is one of the most competitive industries in the world. The nature of competition has slowly but steadily expanded. Historically grocers saw other supermarket chains as their primary competitors. Today, grocers not only compete with one another but also with the food service sector. Currently, grocers and food service establishments compete for approximately equal shares of consumer food expenditures (Figure 2-1).[1]

To cope with this gradual but fundamental change in eating habits, most retail food firms have added various features to store operations that provide shoppers with many of the same conveniences they obtain in food service establishments. These features include added customer services, an emphasis on perishables, and additions to the product line consisting of refrigerated, ready-to-eat items prepared on-site. Such features represent a permanent change in retail operations, and corporate manage-

Currently grocers and food service establishments compete for approximately equal shares of consumer food expenditures.

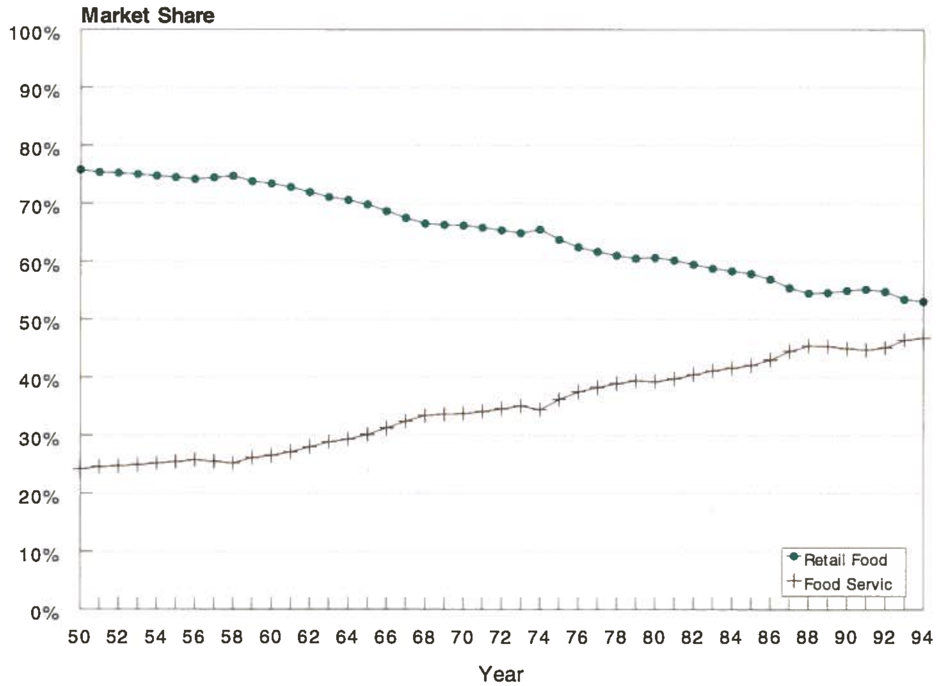


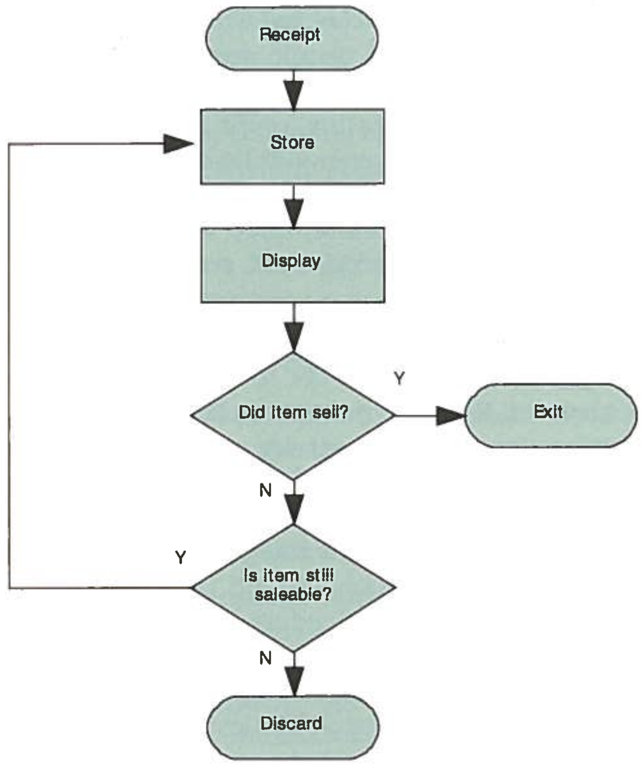
Fig. 2-1. The market share of food expenditures.

ment is bullish on the prospect of their continued importance to store performance. When supermarket executives around the country were asked to rank 26 different competitive tactics, a greater emphasis on perishables was second, more attention to perishable, ready-to-eat foods was third, and increased customer services was fifth.[2]

Full-service seafood departments are complex operations. Seafood departments routinely inventory a wide mix of microbiologically dissimilar raw products as well as a growing line of ready-to-eat items; many prepared on-site. Employees must complete numerous functions during daily operations. In full-service operations bulk-packed inventory is repretitively handled until it sells or is discarded. Thus, most departmental functions impact on the quality and safety of the product line.

The full-service seafood department is an excellent example of how perishables, a growing reliance on ready-to-eat items, and customer service have been incorporated into contemporary retail operations. For example, seafood department personnel handle a diverse array of products and often process some items into more convenient market forms. An important consequence of this wide product line is an equally wide variation in remaining shelf life. Some products arrive with much of their shelf life already consumed as a normal consequence of the elapsed time between offshore production, processing, and transport while other items arrive within a day or two after being harvested and processed. Such dissimilarities in the shelf life of seafood products make accelerated spoilage of fresher products a constant concern because in full-service operations, employees repetitively handle the inventory until it sells or must be discarded (Figure 2-2).[3]

Besides raw products, most seafood departments also offer a variety of ready-to-eat foods. Both raw and ready-to-eat items are inventoried and even prepared within relatively tight physical confines, and, most often,



In full service operations employees repetitively handle the inventory until it sells or becomes spoiled and is discarded.

Fig. 2-2. The retail inventory cycle for refrigerated seafoods.

the same individual routinely handles both types of products. Without proper safeguards, this approach substantially increases the opportunities to compromise product safety. Specifically, cross-contamination between ready-to-eat items and raw products or recontamination of a ready-to-eat product with unclean food contact surfaces such as hands, counter tops, utensils, trays, etc. may accidentally transfer pathogenic bacteria or viruses onto these ready-to-eat foods thereby increasing the opportunities for food-borne illness.

With a growing line of ready-to-eat items prepared and handled in supermarkets, retail managers also need to prevent negligence that compromises the safety of ready-to-eat products. When product safety is jeopardized, the possibility of food-borne illness increases thus setting the stage for litigation and negative publicity.

Meeting the needs of consumers has resulted in operationally complex full-service retail seafood departments. Many functions are required in a full-service department: (a) processing raw fish into more convenient market forms, (b) preparing ready-to-eat foods from prepackaged, precooked ingredients that are subsequently held for sale, (c) custom cooking, (d) repetitively handling both raw and ready-to-eat products until they are sold or discarded, and (e) cleaning and sanitizing a variety of food contact and environmental surfaces. As a result, such departments should be staffed with experienced, technically trained individuals. However, in the competitive business of food retailing, these preferred skills are most often traded off for the cost savings that parttime positions provide. Thus, during part of most days these departments are typically staffed with parttime personnel. Furthermore, the use of parttime employees in most trading areas all but guarantees a perpetually revolving labor pool that pre-empts much formal training.

Labor is a fundamental concern of the grocery industry. Chain management indicates that recruiting the quality of people needed to meet the growing demand for customer service is a more serious matter than achieving profitability or sales goals.[4] Wafer-thin profit margins are the root cause of this concern, and management responds by controlling labor costs through every avenue possible. As a result, grocers are forced to provide more high-end services that consumers say they want — such as preparation advice, on-site preparation of refrigerated, ready-to-eat foods, and custom cooking — with a growing proportion of parttime employees.

Food service also operates with many parttime staff members, but two substantial differences exist between a typical fast food operation and a full-service seafood department. Retail departments lack the narrow, clearly defined job descriptions found in food service operations because most departments are staffed by only one person. For instance, the same employee who began steaming shrimp for one customer must break away from that task to select and weigh an order of a raw product for another patron, only to return to the seasoning, packaging, and labeling tasks required to complete the custom cooking procedure. This sequence of events occurs numerous times daily. The other difference between a food service operation and a full-service retail department is the lack of management oversight. Despite their tenure, experience levels, and the jobs performed, most retail personnel work without direct supervision.

Consumers have very high expectations of food retailers. They want to shop in the most modern surroundings, communicate with departmental staff about product preparation, taste and texture, and purchase "restaurant-type" table fare that can be eaten without any additional preparation. In addition, consumers expect (and certainly should receive) products that are safe, fresh and long-lasting. Finally, and most importantly, they expect these additional services, conveniences, and assurances at competitive prices.

Today, at least half of all necessary departmental functions are completed by parttime individuals who generally work without direct supervision. Handling or holding mistakes that occur through inadvertent actions or improperly designed procedures increase shrinkage expense across the raw product line and boost the possibility of compromising the safety of a ready-to-eat item. However, an effective, simple, resarch-based quality and safety management program can simultaneously minimize shrinkage expense and ensure food safety.

Regardless of the operational complexity that exists in full-service operations, such departments must meet performance expectations established by management while minimizing opportunities to compromise food safety. Individually, each of these two objectives is a major concern. Making service departments contributors to store overhead is challenging because grocers compete for the same customers with virtually identical product lines. Likewise, liability threats and media sensationalism are significant obstacles that the retail firm first must mark and then steer around. The current labor situation heightens these concerns because grocers must use parttime personnel to provide the "high end" customer services expected in full-service departments. The net effect is to make conversion of consumer demand into sustained economic performance more elusive, and magnify the obstacles of liability and media scrutiny even more.

Both profitability and food safety can be ensured with a research-based quality and safety management program. In fact, without such a program in place, meeting economic targets while minimizing negligence and withstanding media scrutiny seems all but impossible. The remainder of this chapter presents compelling evidence for such new retail management functions.

Realizing Sustained Profitability from the Market Success of Seafood

A growing commitment to perishables programs has important profitability implications for the grocery industry. Simply stated, if full-service perishables departments like seafood are expected to play a more prominent role in retail operations, then they must make a contribution to store overhead proportional to that prominence.

Making a contribution to store overhead is best ensured by reducing avoidable departmental costs. Shrinkage that occurs because of accelerated spoilage is a large, mostly avoidable cost in seafood departments.

Despite its consumer appeal, profitability is lagging in many seafood operations. This track record makes a compelling argument that demand alone provides no guarantee of profitable operations. Conceivably, three approaches (or combinations) can be used to generate a contribution to store overhead: (a) increase departmental sales volume, (b) increase the departmental weighted average gross margin, or (c) reduce departmental costs. Even though increased profitability is possible with each option, demand issues and the operating conditions in the grocery industry suggest that neither increasing sales volumes or boosting gross margins have much chance of meeting profitability objectives. This is best demonstrated with the following hypothetical retail seafood department. Consider these characteristics:

- a full-service retail department with a sales base of $5,000 per week,
- a 20 percent weighted average gross margin,
- shrinkage accounting for 12.5 percent of sales,
- $30,000 in annual, direct departmental expenditures, and
- a requirement that 1 percent of departmental sales be contributed to store overhead.

If this hypothetical department is to meet its contribution target by selling more, sales must increase by a whopping 77 percent! Such increases appear unlikely because per capita consumption of all meats is growing slowly at roughly 0.69 pounds per year (Figure 2-3).[5] A review of these data by product line suggests that growth in one product line occurs at the expense of other categories (Figure 2-4).[6] For example, the computed consumption trend for red meat shows an annual decrease of 0.66 pounds while the trend for poultry demonstrates a 1.19 pound increase. Annually, seafood consumption has increased by 0.16 pounds. When purchases of one meat type proportionally offset purchases in other categories, the

Significantly increasing the sales volume of seafood appears unlikely given that the per capita consumption of all meats is growing at only about 0.69 pounds per year.

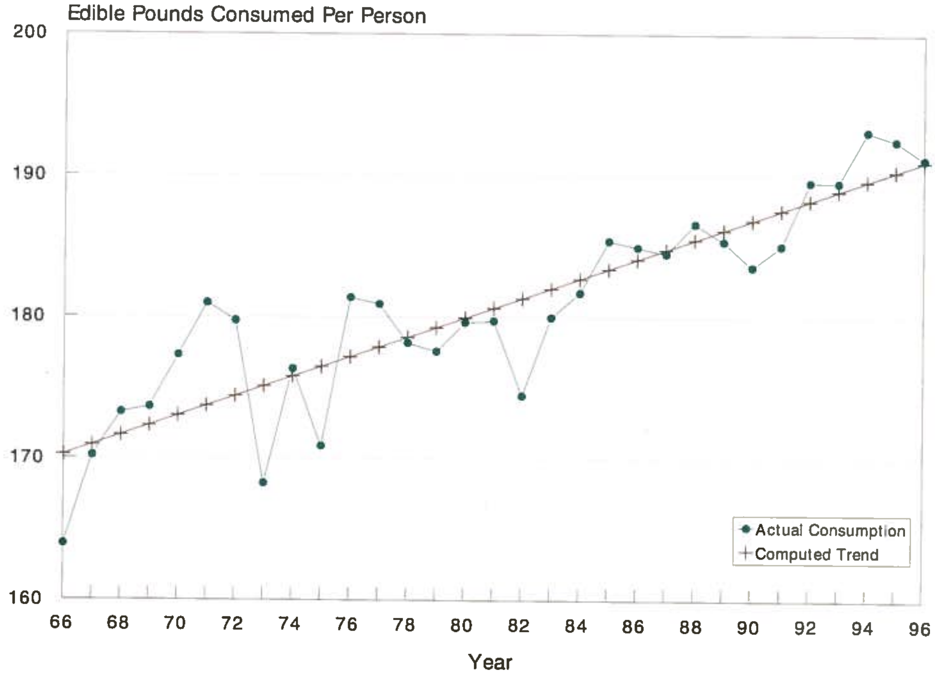


Fig. 2-3. Actual per capita consumption of meats versus the computed trend.

Most of the increase in meats consumption is due to poultry, not seafood or red meats.

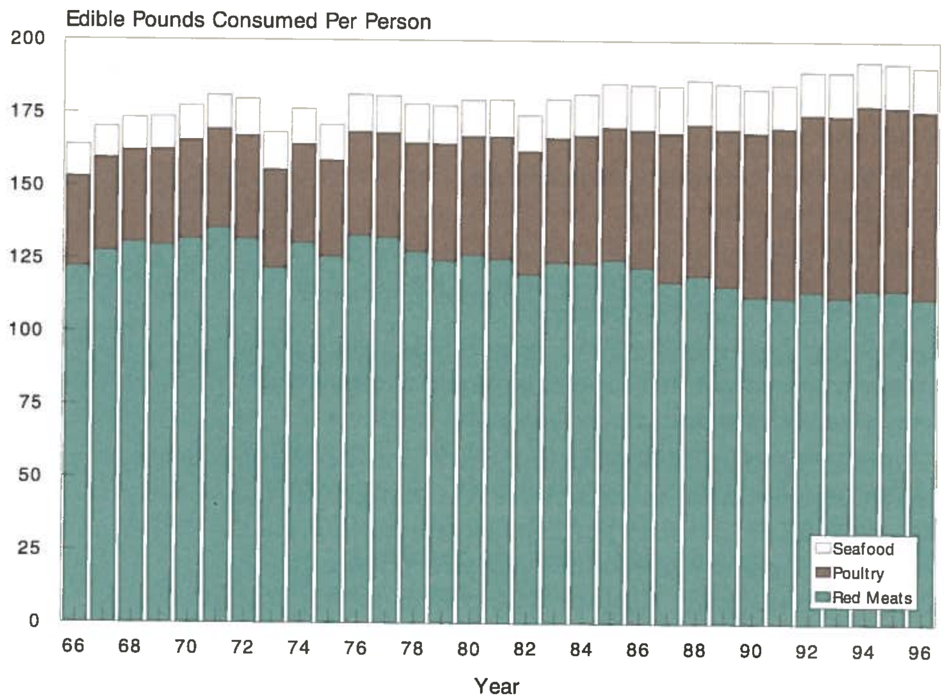


Fig. 2-4. U.S. per capita consumption of red meats, poultry and seafood.

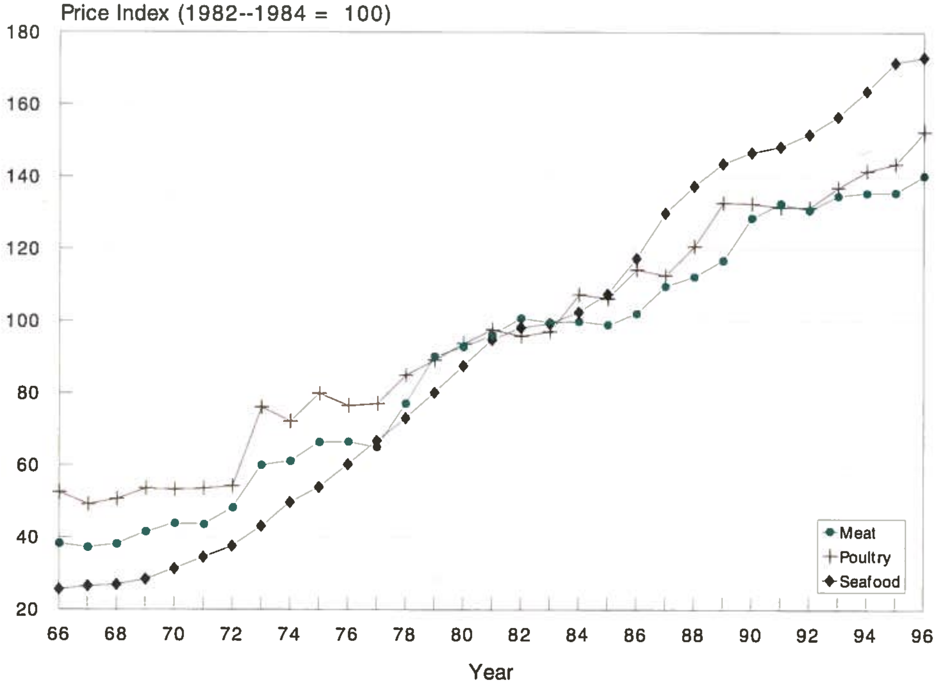


Fig. 2-5. Consumer price index for red meat, poultry and seafood.

Seafoods are the highest priced meat items, currently retailing for roughly 18 percent more than either red meats or poultry. Relatively high prices create a significant barrier that prevents increasing the gross margins on commonly available items.

message to grocers is clear: all meats must generate a contribution to store overhead, or the contributions made by the market will decrease.

Margin increases are another possible way to convert a market success into sustained economic performance. Given the hypothetical department conditions outlined above, the 1 percent contribution to store overhead can be generated if the weighted average gross margin increases by five percentage points. However, the opportunities to increase the weighted average gross margin generated by the department are typically overplayed for two primary reasons. First, seafoods are the highest priced items in the meat mix, currently retailing for roughly 18 percent more than red meats or poultry (Figure 2-5).[7] Second, the margins on commonly available items that comprise the vast majority of sales volumes are governed by competitive factors. Setting prices above the competition on these items most often results in lower volume. Of course, some unique elements of a firm's seafood mix could be priced higher, but generally these items make a minor contribution to total movement. Therefore, to generate the necessary percentage change in the departmental weighted average gross margin, a few items would have to be exorbitantly priced. This approach, too, seems improbable.

Reducing accelerated spoilage in service departments where parttime staff members perform numerous repetitive functions is best ensured with a management system that prevents handling and holding errors. This quality management system should be based on scientific principles that are translated into simple, time-efficient, understandable procedures.

If sales volumes and gross margin increases offer limited opportunity to make a contribution to store overhead, the only avenue left is cost control. Some have argued that additional labor savings are possible, but most full-service seafood departments are operated by a single individual. During the afternoon and evening shift, the person on duty is typically a parttime employee. Thus, it seems that substantive reductions in labor cost will be difficult to find and still keep "service" in the department.

In a typical retail environment, small reductions in shrinkage cost can have the same impact on departmental profitability as huge increases in sales volumes or selling prices.

On the other hand, shrinkage is a direct departmental cost that can be reduced. Shrink is a significant cost across the refrigerated seafood product line, and accounts for 10 to 15 percent of total departmental sales.[8] Shrink is often considered the inevitable economic burden of inventorying items with a finite shelf life. Some shrink is inevitable and unavoidable since the time required to move a product may exceed its remaining shelf life. This situation is exacerbated with seafoods because, in many instances, a significant amount of shelf life has been consumed before retail receipt. In fact, retailers often exert management control over no more than the last 20 to 25 percent of remaining shelf life that, for many species, amounts to approximately 70 to 85 hours.[9] However, when the sources of total shrink are scrutinized, a significant percentage is clearly controllable and thus avoidable. Avoidable shrink can occur through numerous means including:

- theft (by employees or customers),
- paying for products not received (i.e., discrepancies between invoices and deliveries),
- ordering products for which there is no demand, and
- improper in-store procedures and practices that result in accelerated spoilage.

The vast proportion of avoidable shrinkage can be sharply reduced by better communication of specifications to vendors, better management of product mix decisions, and better in-store processes. Solutions for several causes of avoidable shrinkage have been well researched and reported to industry. For example, much has been written about working with suppliers to develop common specifications and mutually agreeable criteria for evaluating deliveries.[10,11,12] Industry has taken the lead in solving other sources of avoidable shrink. Better internal control that minimizes opportunities for theft is an excellent example. Another is use of scan data that enables managers to evaluate demand and coordinate inventory needs to meet expected movement patterns. As always, more work can be done in these areas to find, communicate, and carry out other workable solutions.

Rapid consumption of remaining shelf life (accelerated spoilage) occurs because of two conditions: (a) high product temperatures that speed the growth of spoilage bacteria and (b) inadvertent contact among microbiologically dissimilar products (i.e., items with different levels of spoilage organisms). Contact among microbiologically dissimilar products inoculates newer products with the higher bacterial loads associated with products having less remaining shelf life. In addition, methods that do not ensure that products with the least amount of shelf life are sold first may also account for a significant proportion of avoidable shrinkage.

To reduce accelerated spoilage and pass along fresh, long-lasting seafoods to consumers, the practices and procedures used by departmental personnel must *simultaneously* minimize contact among microbiologically dissimilar items, maintain low product temperatures, employ good sanitation practices, and respect stock rotation sequences throughout the inventory cycle (Figure 2-2, page 7). If all these criteria are not satisfied at each step within the cycle, remaining shelf life can be rapidly consumed. Aside from its chronic, proportional effect on the bottom line, the factors responsible for accelerated spoilage can lead to reduced demand for seafood. With perishable products, reduced demand increases shrinkage.

Practical solutions to the accelerated spoilage riddle have not been well researched. Therefore, the retail community has, itself, set about trying to reduce accelerated spoilage with various "common sense" approaches. Unfortunately, the retail environment is perhaps the last place to experiment since the proportional causes of spoilage cannot be isolated. As a result, many procedures commonly used in retail seafood departments are counterproductive. Some procedures create additional work for employees while doing nothing to reduce accelerated spoilage. Frequently, the mandated procedure exacerbates the very problem retailers have attempted to overcome. Perhaps the best example of such a procedure is "washing" products before placing them in the display case. Even if done properly, "washing" or rinsing is a time-consuming exercise that offers no shelf life advantage to the department. Yet if done improperly, "washing" contributes to widespread accelerated spoilage.

On the other hand, a quality management program based on scientific principles and organized around the operational environment of a full-service retail department can sharply reduce accelerated spoilage, thereby generating an immediate, proportional increase in the bottom line. Assuming that such a program was available and implemented in the hypothetical department described previously, the required 1 percent contribution to store overhead can be met by shaving four percentage points off the shrinkage value. Importantly, the departmental profitability objective is achieved without increased sales volumes or higher prices.

Intensified Regulatory Surveillance and Increased Liability Exposure

Retail managers view the ready-to-eat line as an excellent way to meet the convenience demands of consumers and recapture a portion of the revenue now spent in food service establishments. Simultaneously, such items represent the retail community's greatest potential danger since improperly prepared, stored or displayed ready-to-eat products may become public health risks. The possibility of public health violations — no matter how remote — mandates regulatory oversight to verify compliance with food safety regulations and subjects the firm to increased liability exposure.

When compared against the number of meals served and eaten in this country, severe food-borne illnesses are infrequent occurrences. Nevertheless, food-borne illnesses can create swift, dramatic, disproportionate economic losses for the affected firm. A severe food-borne illness that resulted from a $3 purchase can cost a firm several million dollars via litigated solutions or out-of-court settlements. Product recalls are also costly, both in immediate, out-of-pocket expense to repurchase items recalled and the bad press that accompanies these events.

Historically, retail liability centered on physical accidents (slips and falls) that occurred on store property. Today however, liability exposure has expanded and includes food-borne illness that may occur through retail negligence. This additional liability involves more people, and occurs outside the store. Although food-borne illness is an infrequent occurrence, its impact is significant — potentially affecting the entire corporation.

Liability is a part of all commercial activity, and grocers have always faced such exposure. Thus, rapid clean up of spills in aisles, immediate compliance with product recalls from manufacturers, etc. offer compelling evidence that food retailers consider liability an extremely serious issue. Yet, liability exposure originating from food-borne illnesses, which are traced to **retail negligence**, have been relatively limited because on-site preparation and holding of perishable, ready-to-eat foods *was* a rare occurrence. However, with more on-site preparation of ready-to-eat foods, retailers are now more than pass-through merchants. This heightens their exposure.

An aisle spill and an unsafe perishable, ready-to-eat food both affect personal safety; yet, little common ground exists between these two threats. Aisle spills are classic examples of tightly defined liability threats affecting a very limited number of individuals, whose identities are immediately known. On the other hand, the liability threat from an unsafe product is potentially very broad since it affects the purchasers and anyone else who consumed the product. Retailer knowledge of potential liability threats are very different as well. Once an aisle spill occurs, the grocer can take immediate steps to minimize the firm's liability exposure by temporarily cordoning off the aisle, quickly cleaning it up, and announcing the problem on the public address system; both to mobilize store personnel and minimize aisle traffic. However, with a food-borne illness retailers have no way of knowing a problem exists since (a) ready-to-eat foods typically provide no sensory clues to grocers or consumers that the product should not be eaten and (b) the food-borne illness occurs after consumption. Management attention to injuries sustained from the two events is also different. Once management learns of an aisle spill, they can arrange immediate medical attention for victims who slipped and were injured. Conversely, the grocer is in no position to provide necessary assistance for victims of a food-borne illness since it occurs outside the store. Table 2-1 summarizes key differences between the liabilities associated with personal safety threats that originate from these two sources.

In addition to greater regulatory surveillance, a new type of public oversight has surfaced with potentially staggering economic effects: scrutiny by an aggressive, opportunistic media. Various investigative reports by the media — such as several episodes of *Prime Time Live* and articles in *Consumer Reports* — have commented on the quality and safety of seafood products under retail stewardship. While questions remain about (a)

Table 2-1. Comparing the Extent and Control of Liability Threats That Originate from an Aisle Spill and a Food Borne Illness		
	Origin of The Liability Threat	
	A spill in an aisle...	A food borne illness...
How much time elapses between an accident and the associated liability?	No more than several minutes between spill and cleanup.	Lagged effect after consumption of the product. Several days could elapse before the connection is made to particular unsafe food.
Can the severity and magnitude of the problem be immediately determined?	Yes—The retailer can quickly determine the number of people at risk and their identities based who was on the aisle when the spill occurred. If anyone slips, the potential liability exposure is immediately known.	No—The grocer cannot accurately estimate how many individuals were potentially exposed or who may become ill. Potentially, that number includes all who consumed the unsafe product including those who purchased the food, their families and friends. Also, the grocer does not know what proportion of the food supply is unsafe. Compromised product safety can occur instantaneously, and there are no sensory cues that suggest a particular product is unsafe.
Can the event/conditions creating the current liability threat be minimized?	Yes—by immediately cleaning up the spill, announcing the problem over the P.A. system, posting signage during the cleanup to minimize aisle traffic, etc.	No—There would be no method available to minimize the current threat because the retailer has no specific knowledge of the problem, who purchased the product, or who consumed it.
Can the retailer provide any immediate response to affected customers?	Yes—Store personnel can assist victims, arrange for transportation to medical treatment facilities (if necessary), etc.	No—The victim(s) are on their own to seek medical attention (if necessary) since the problem occurred outside the store after consumption.
What can management do to minimize liability exposure from subsequent events?	Have a predefined plan for immediate cleanup, medical attention, etc.	**Develop a preventive safety management program that minimizes the opportunities for otherwise wholesome ready-to-eat products or ingredients to become unsafe through cross-contamination, recontamination, improper cooking, or improper holding temperatures.**

whether appropriate scientific methods were used and (b) whether the conclusions reached were accurately derived, such reporting created major public relations problems for the affected companies. Ultimately, the targeted firms experienced devastating impacts including reduced customer confidence (and thus store traffic), reduced corporate earnings, and termination of store development ventures in midstream.

The negative public relations associated with investigative reporting and the liability exposure from unsafe foods frame the downside risks of meeting customer demands for custom-prepared, "restaurant-quality," ready-to-eat foods. Ironically, the ready-to-eat convenience products, that have emerged as the grocery industry's best defense against a growing food service sector, carry the greatest liability risks. Litigated solutions are at record levels. With many retail food firms among the largest American corporations, a wide target with "deep pockets" is presented to plaintiffs.

Providing effective, streamlined, simple-to-understand safety management systems sharply reduces the opportunities for employees to create food safety problems that can result in litigation, media scrutiny, or additional regulatory oversight.

Steering around the obstacles of heightened scrutiny and liability requires a research-based quality and safety management program that prevents compromises to product safety. This program must be specific yet understandable to the parttime employee who may be asked to steam a pound of shrimp during the afternoon/evening rush while he continues to select, weigh, and package raw products for other customers. Without such a program, the retail firm is in a virtually indefensible position since the employee who may unwittingly compromise the safety of an otherwise wholesome ready-to-eat product typically works without direct supervision.

Conclusions

Compromised seafood quality and safety cost the retail food sector dearly, both in lost profits and bad press. Refrigerated seafood shrinkage is a significant departmental cost that proportionally reduces departmental contributions to store overhead. The factors that manifest excessive shrinkage may raise customer concerns about the safety, freshness, and time available to use seafood purchases. These consumer perceptions could affect purchase patterns, thereby lengthening inventory turnover rates. For perishables departments, such a situation would create a self-fulfilling prophecy of continued increases in shrinkage. Unlike the chronic, proportional expense of accelerated spoilage, severe food-borne illnesses have potentially staggering economic consequences for the affected firm. One severe food-borne illness can cost a firm millions via litigated solutions or out-of-court settlements, and bad press that erodes consumer confidence and reduces sales volumes. Yet, lagging profitability, negative public relations, and the threats posed by litigation can all be successfully resolved by upgrading the existing retail quality and safety management program.

The design and implementation of effective, efficient quality and safety management programs requires the time of top and middle managers. What benefits can be expected from this investment? Benefits fall under two main categories: (a) internal operational effectiveness and (b) profitability. Internal operational effectiveness establishes exact procedures for all retail tasks such as setup, closedown, preparation of ready-to-eat products, custom cooking, etc. By developing precise methods for completing the numerous tasks required in full-service departments, correct procedures are established that are consistent across the chain and over time for all employees. With additional regulatory scrutiny of the retail sector anticipated, an effective, efficient quality and safety management program should afford rapid evaluation by managers for compliance. Also, research-based quality and safety management programs should reduce retail liability exposure and diffuse negative public relations by providing the firm with a defensible position should challenges arise.

While internal operational effectiveness helps the firm meet higher levels of consumer, media and regulatory scrutiny, the experience of other industries suggests that the primary benefit of upgraded quality and safety management is its effect on the bottom line. Identifying and using new pathways to sustained profitability is key to the grocery community since food retailers compete for the same customers with similar product lines. The design and implementation of quality and safety management plans are one of the few operational assets not easily copied by the competition.

The economic benefits derived from using efficient, effective, research-based quality and safety management programs are real. Initially, cost savings from reduced shrinkage "fall" right to the bottom line and result in higher unit profitability on each item sold. Over time, marketing safer, fresher, longer-lasting products should increase the chain's sales volume by attracting new customers away from competitors. The net effect of improved quality is the ability to sell a greater volume of more profitable items that are priced on par with the competition. **This is an unbeatable combination!**

It is important to realize that this upgrade process requires more a redirection of thinking than a redirection of funds to purchase "necessary" assets. In fact, the experiences of other industries suggest that the return on investment from quality and safety improvement programs is huge since few out-of-pocket dollars are required. But low costs are only part of the picture. The other side of the equation is that the benefits accruing from such quality and safety improvement activities are substantial and long lived. Thus, instead of measuring the flow of nickels earned per investment dollar, firms that have successfully implemented quality improvement programs can literally measure the dollars earned from each nickel invested!

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Chapter 3

Seafood Product Characteristics Important in the Design of Quality and Safety Management Systems

Overview

The previous chapter demonstrated that a well-designed quality and safety management program was the common link among sustained economic performance as well as sharp reductions in liability threats, and the potential for negative media publicity. This chapter focuses on seafood product characteristics. It begins by summarizing the factors that influence the shelf life of refrigerated seafoods. Next, the principles behind maximizing shelf life are outlined. Understanding these principles is essential because each container of product in the retail seafood mix has a bacterial load and, thus, a remaining shelf life that is different from all others. These differences exist when each container (e.g., a box, poly bag, tote, etc.) is received. In addition to each container having a different amount of remaining shelf life, the shelf life of otherwise identical fillets, steaks, etc., that arrive in the same container can differ during retail stewardship. Besides shelf life issues, various food safety concerns are reviewed, including the magnitude of seafood-borne illness, and its most likely origins stemming from retail operations. Using numerous examples, this chapter will demonstrate that the same tools that minimize accelerated spoilage also minimize food safety concerns. This is a key realization, and one that will greatly simplify the design of quality and safety management systems.

Raw Seafood Products

The transition all refrigerated seafoods make from fresh to putrid is inevitable and predictable. In controlled experimentation, haddock held in storage at a constant 32°F since death underwent four distinct phases as it traversed from a fresh product still in rigor to a spoiled state (Figure 3-1).[1] This timetable demonstrates the spectrum of odor, texture, and flavor changes that result under the best of circumstances; that is, constant, low product temperatures and no handling or processing.

Changes in odor, flavor and texture are caused by two distinct processes. Upon death, changes in the freshness of seafood result from continuing enzymatic activities of the organism. Enzymatic changes occur rapidly, and are generally of short duration — one to three days. As the number of days since death increases, enzymatic processes render tissue suitable for bacterial growth that leads to spoilage. After rigor mortis, spoilage bacteria gain a "foothold" because naturally occurring defenses that protect a living product against the effects of bacterial action become ineffective. Even under refrigerated storage, this lack of defense, combined with

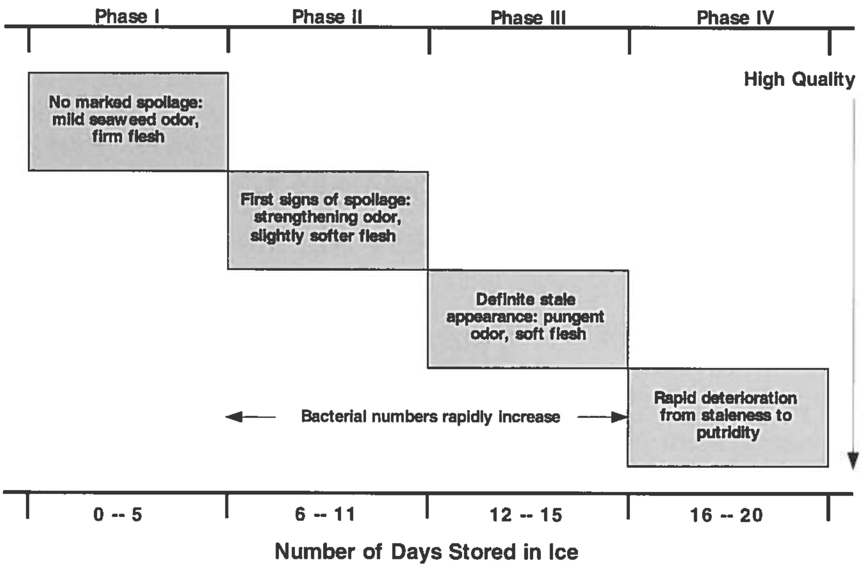

Fig. 3-1. Generalized quality changes in whole finfish held under ice since capture and death.

enzymatic softening of tissues and the availability of nutrients, allows bacteria naturally present in the gills, gut, and surface slime to multiply.

Processing unavoidably distributes spoilage organisms across otherwise sterile muscle surfaces. The ultimate effect of spoilage bacteria is well known to food retailers and shoppers alike; taking the form of strong, obnoxious odors as products near the end of their shelf life.

Seafoods are more perishable than other meat items because of their chemical composition, habitat, and muscle structure. From a chemical standpoint, marine foods contain large quantities of small molecular weight compounds which bacteria can quickly digest. Upon death, enzymatic activity breaks complex proteins into smaller segments that are also readily used as food by bacteria. In cold-blooded animals such as fish, these enzymes are active even at refrigerated temperatures. Rapid spoilage also occurs because the bacteria normally present in the gut and intestinal tract and on the surface slime are adapted to cool aquatic or marine habitats and thus grow well at refrigerated temperatures. Finally, relatively little fibrous connective tissue in aquatic foods results in rapid textural changes.

Determinants of Shelf Life

While changes in quality are inevitable and uncontrollable, the shelf life of marine food products is determined primarily by two parameters: (a) initial abundance of spoilage bacteria on product surfaces and (b) product temperature.

- Little that can be done to remove or reduce initial numbers of spoilage bacteria from product surfaces and still have a raw product. Essentially this is a condition that must be accepted in full-service operations.
- However, much can be done to prevent the transfer of additional

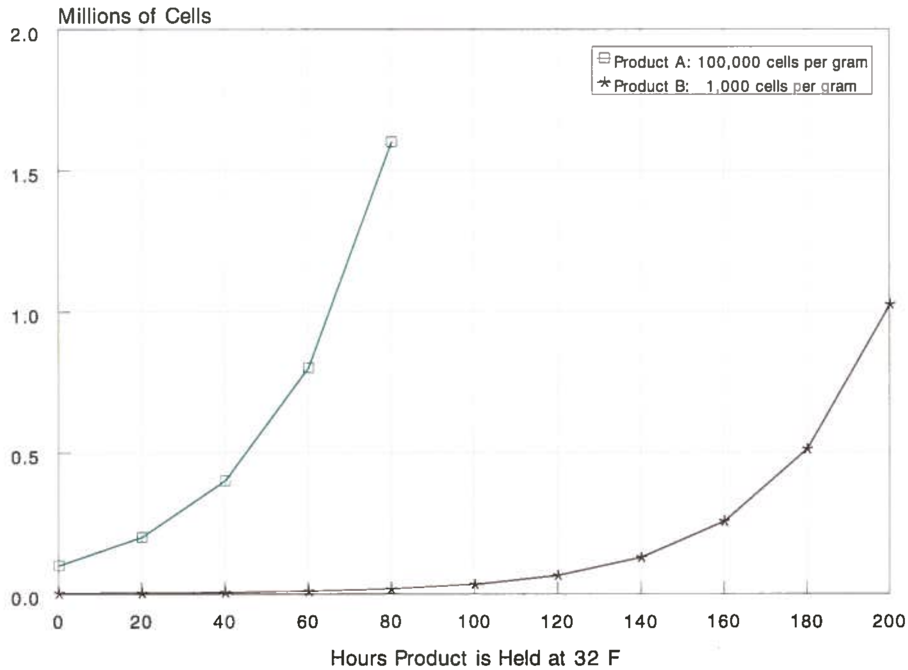

Fig. 3-2. Elapsed time (hours) required to reach threshold spoilage levels based on initial counts.

Shelf life of seafood products is influenced by initial bacterial numbers. The producer (fisherman) and first receiver (wholesaler) largely determine this number based on handling procedures and storage temperatures.

spoilage bacteria onto product surfaces. This is achieved by minimizing contact among dissimilar products and ensuring that food contact surfaces are clean and sanitary.

- Likewise, product temperature is controllable, and is another primary tool available to maximize shelf life across the entire product line.

Initial Abundance of Spoilage Bacteria

Bacteria grow by dividing. One bacterium becomes two; two become four, etc. Each doubling of a bacterial population is called a generation.

Initial abundance is a prime determinant of shelf life because of the way that bacteria reproduce. Through fission one bacterium becomes two, two become four, four become eight, etc. Each doubling of an existing bacterial population is called a generation. Because bacteria grow by dividing, the number of generations required for an existing population to reach some future threshold spoilage level depends on initial abundance.

To illustrate the impact that initial abundance has on shelf life, assume that one million spoilage organisms (cells) per gram is a threshold spoilage level and that product A has an initial count of 100,000 cells. Therefore, roughly three generations are necessary for product A to reach threshold spoilage levels (e.g., 100,000 x 2 = 200,000; 200,000 x 2 = 400,000; 400,000 x 2 = 800,000). Product B has a less abundant microflora, with an initial level of 1,000 cells per gram. To reach the threshold spoilage level, bacteria on product B must double themselves 10 times. If both products are stored at 32°F, each generation takes approximately 20 hours.[2] Therefore, product A reaches spoilage levels in roughly 60 hours (2.5 days) while product B reaches threshold spoilage levels after 200 hours (8.3 days) (Figure 3-2).

Storage and Display Temperature

Given an initial number of bacteria, temperature is the primary determinant in the time required for bacterial populations to double. At 32°F, the generation time is 20 hours. However, as temperatures increase, generation times become shorter. With shorter generation times, products reach threshold spoilage levels sooner. The effect different product temperatures have on shelf life is well documented. Numerous studies over the years all point to the same basic conclusion:

> *Remaining shelf life is disproportionately lost whenever temperature slightly increases above 32°F over a lengthy holding period or whenever a short-duration spike in product temperature occurs.*

For instance, cod fillets held at 32°F since capture and death are still of acceptable quality at the end of 14 days (336 hours) (Figure 3-3).[3] However, fillets held at 36° F will be acceptable for only 10 days (240 hours). This 4°F increase in product temperature, which is almost indistinguishable to the touch, reduces total shelf life by four days (96 hours). In this case a 12.5 percent increase in holding temperature resulted in a 29 percent reduction in total shelf life. Thus, at lower storage temperatures, slight increases in temperature translate into disproportionate reductions in the length of time the product can be held.

Another way to interpret the effect of holding temperature is to consider the hours of shelf life lost for each hour the product remains at a given temperature. This is a useful approach for managers interested in computing the shelf life consumed based on product temperature and the length of holding period. Products held at 32°F (the temperature of ice) will lose one hour of shelf life for each hour held at that temperature (Figure 3-4). As product temperatures increase above 32° F, hourly shelf life consumption rates increase and double between 32° F and 40°F. For every 10° F increase above 40° F, the shelf life consumption rate also doubles. For example, at 40°F, a fillet will lose shelf life at twice the rate of products held at 32°F. The same product held at 50°F will lose shelf life four times faster than if stored under optimal conditions (32°F). Thus, if fillets are held for five hours at 32°F, 40°F, and 50°F then five, 10, and 20 hours of shelf life will respectively be lost over the same holding period.

Just as slight increases in holding temperature above 32°F can have a dramatic effect on total shelf life, short-duration temperature "spikes" also create a disproportionate reduction in total shelf life. In controlled experimentation, products held at 33°F were removed from storage and exposed to ambient room temperatures between 68°F and 72°F for four hours, then returned to optimal storage conditions. The control group was held continuously under 33°F storage conditions. A trained sensory panel evaluated both batches each day during the experiment. The batch exposed to ambient conditions was judged "spoiled" *one day sooner* than the batch held at continuously low temperatures.[4]

This paired evaluation has a significant implication for food retailers. The four hours that product remained at ambient room temperature

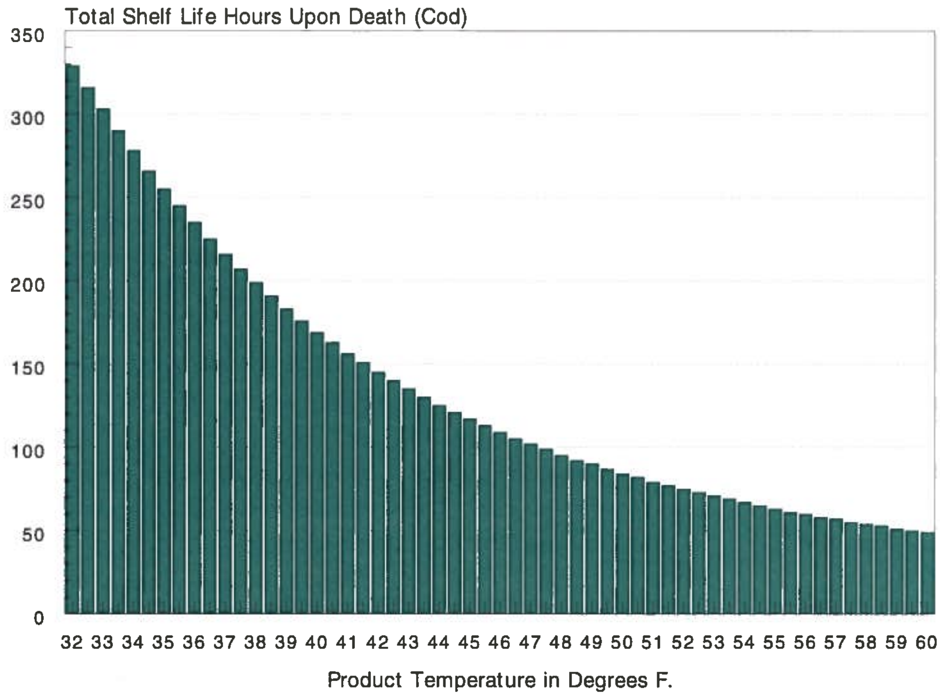

Fig. 3-3. Number of hours cod (*Gadus morhua*) is acceptable as influenced by product temperature.

An increase in product temperature from 32°F to 36°F (12.5 percent) reduces total shelf life by 96 hours (29 percent.

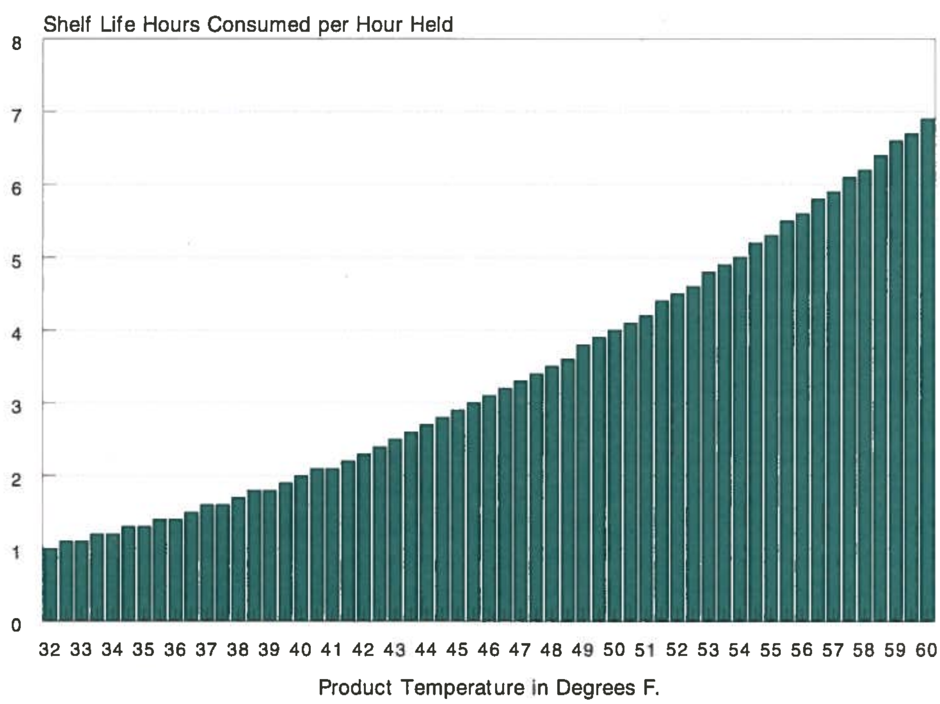

Fig. 3-4. The number of shelf life hours consumed for each hour the product is held at different temperatures.

The rate at which shelf life is consumed depends on product temperature. As temperatures increase from 32°F, multiple hours of shelf life are lost with each passing hour.

Exposing products to ambient store conditions for even short amounts of time (three or four hours) can shave an entire day off the time available to sell the product. To maximize remaining shelf life, product temperatures should be constantly maintained at 32° F.

amounted to just 2 percent of total shelf life. However, that translated into an 11 percent (24 hour) reduction in time available to sell the product. Allowing a product to remain at ambient room temperatures for even short periods such as lunch breaks, or during stocking, prepping, etc. can sharply reduce time available to sell the product. Therefore, grocers need to be vigilant about ensuring optimally cold product temperatures continuously during retail stewardship.

Regardless of the total amount of shelf life remaining, the time available to sell the product is maximized when the rate at which shelf life is consumed is minimized. To minimize shelf life consumption rates, constant low temperatures are required. *With seafood products, low product temperatures are those that hover around 32°F.* These product temperatures are best achieved by surrounding products with ice.

Procurement and Marketing Practices That Influence the Design of Quality and Safety Management Systems

Upon receipt, each item in the seafood mix has a unique amount of remaining shelf life. Shelf life differences can also be created among otherwise identical items in a container if some items are handled more (as they move from storage to display) or if case temperatures are higher than storage conditions.

A delivery of beef, pork or poultry products consists of items converted from a few similar species, and processed on the same day under identical conditions. This suggests that remaining shelf life is quite consistent across all items in the delivery because each product has about the same abundance of spoilage bacteria. However, a delivery of seafood products stands in sharp contrast to the homogeneity in product shelf life found with domesticated meat products. Remaining shelf life among components of seafood deliveries is anything but standardized — nor can it be — given the diversity among species, methods of capture, means of processing, differences in elapsed times since death and processing, and the required transportation distances.

One must consider, for example, that farm-raised catfish are delivered live to processing plants, and are generally under retail control within two or three days after death. At the other extreme, many wild-harvested products enter retail settings with a significant proportion of their shelf life already consumed. In fact, many wild-harvested products pass through the Phase I stage (Figure 3-1, page 20) aboard the fishing vessel since the economics of hunting — particularly in the offshore environment — require increasingly longer trips. Under these circumstances, the interval between death and processing may be five to seven days. By the time retailers receive these products they are Phase II inventory (page 20). Phase II inventory is safe, wholesome, aesthetically pleasing, and can be held for several days. However, the abundance of spoilage organisms on Phase II items is greater because of the elapsed time between death and retail receipt, and this translates into less time to sell these products.

Most seafood departments inventory between 15 and 30 different items. This wide mix complicates management of quality because the remaining shelf life for each container of product is generally different from the rest of the product mix. In addition to shelf life differences among containers, shelf life differences can be created among container contents (i.e., individual filets, steaks, etc.) during retail stewardship. Because of the inherent variation in remaining shelf life and since bacteria are immobile, handling procedures must be carefully designed to prevent microbiologically dissimilar items from contacting one another. If inadvertent contact is not prevented, those items with high bacterial loads can inoculate the entire product line resulting in widespread accelerated spoilage.

The inherent differences in remaining shelf life create more opportunities for inadvertent contamination by employees if they do not wash and sanitize hands or change gloves when handling different items. When different raw products contact one another, directly or indirectly, widespread, accelerated spoilage is the result.

The mechanics of inoculation are simple. Upon contact with a dirty surface or an "older" product, a higher bacterial load is transferred to the "fresher" item. Contact that results in inoculation can be instantaneous, yet it leaves no immediate evidence. The damage is permanent though, and shows up later as reduced shelf life. Any action that increases the abundance of spoilage bacteria on refrigerated products significantly reduces remaining shelf life because fewer generations are required to reach threshold spoilage levels (Figure 3-2, page 21).

Product contact can be direct or indirect. Direct contact occurs when dissimilar products physically touch one another. This can happen when inventory is removed from storage and placed in the display case or when the case is unloaded for the evening. If display and storage temperatures are significantly different, otherwise identical products out of the same container *can* become dissimilar through time when part of the package contents is placed on display while the remainder stays in storage.

To illustrate how fillets from the same container can become dissimilar over time (one day), assume that fillets are received and placed in refrigerated storage. Further assume that all fillets in the container have a surface count of roughly 50,000 spoilage bacteria per gram. At 7:00 a.m. some fillets are removed from the package and are placed in an ice-only display case where product temperatures average 50° F. At 50°F, the spoilage bacteria commonly found on most seafood products would double every 3.3 hours. By 8:20 p.m. the fillets have not sold. The combination of elapsed time (13.3 hours) and product temperature (50°F) has resulted in a spoilage micro-flora that amounts to 800,000 cells per gram — practically reaching threshold spoilage levels by day's end. Conversely, microorganism growth on the stored product is *unchanged* because at 32° F the generation time is 20 hours (Figure 3-5). The previously displayed product has 16 times more spoilage bacteria on its surface than those fillets held in storage (e.g., 800,000 cells per gram compared with roughly 50,000 cells per gram). Therefore, returning previously displayed merchandise to packages held under constant, optimally low temperatures would inoculate the stored product.

Indirect contact is less obvious, but the opportunities are much more

Items from the same container held at different temperatures will have different amounts of remaining shelf life at the end of a day. In this comparison, one item approaches spoilage levels by the end of the day when displayed at 50°F while microbial growth on an identical item held under ice in a walk-in cooler experiences no change in the number of spoilage organisms.

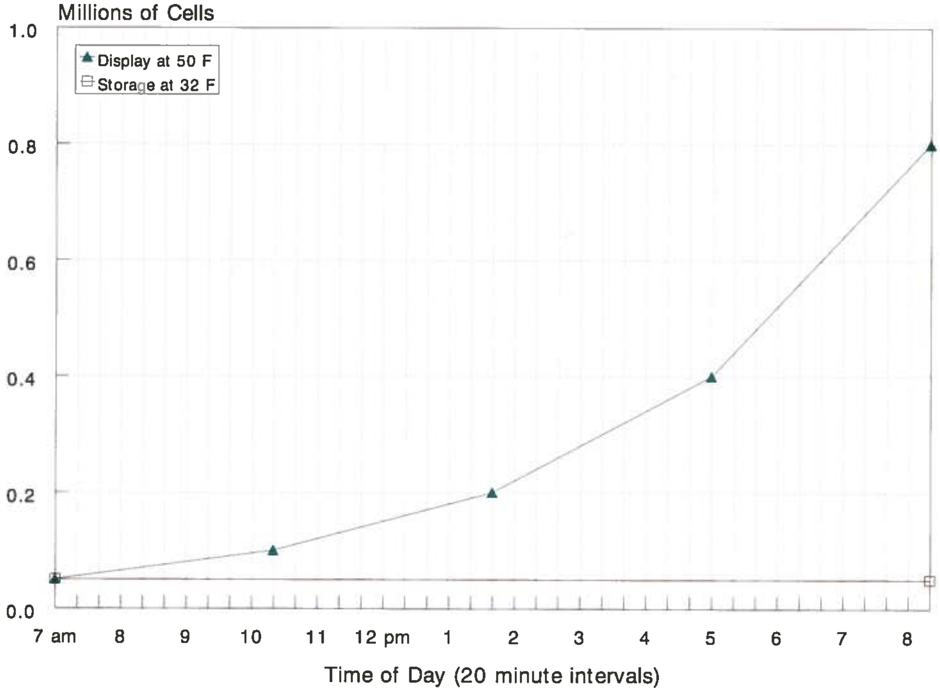

Fig. 3-5. Changes in abundance of spoilage bacteria as a function of holding temperature and elapsed time.

numerous. For example, employees failing to wash their hands or change disposable gloves between handling different products become pathways for inoculation. Equipment can also be a pathway. Examples include using uncleaned product containers, placing a product directly on uncleaned food contact surfaces such as counter tops, or using uncleaned knives for processing. The practice of chilling raw products in slush ice prior to display is perhaps the best example of inadvertent, widespread, indirect contact among microbiologically dissimilar items. Inoculation from this procedure can happen in two ways. Adding products to an uncleaned, unsanitized sink inevitably transfers spoilage bacteria onto product surfaces. However, the biggest source of inadvertent bacterial inoculation is dipping different products in the same ice water bath without changing water and cleaning and sanitizing the sink between rinsing different containers of product.

To prevent contamination, retailers must assume that all refrigerated seafood products are dissimilar with respect to remaining shelf life. Thus, any two species are dissimilar as are any two market forms of the same species. Identical species and market forms arriving on subsequent days are also different. Also, identical package contents *become* dissimilar if a portion is placed on display, and display and storage temperatures are significantly different.

Maximizing Shelf Life at the Retail Level

Shelf life is maximized when direct or indirect contact among microbiologically dissimilar products is sharply reduced and product temperatures are constantly maintained around 32°F. This suggests that managing shelf life at retail is predicated on preventive methods. Ultimately, this means:

- developing stepwise procedures that prevent direct or indirect contact throughout the retail inventory and
- ensuring optimally cold product temperatures.

Some managers have questioned whether there are any technological treatments that can protect raw products from inevitable inoculation and time/temperature abuses that occur within retail operations. In fact, retailers themselves have explored ways to ameliorate the problems of short shelf life using various preparatory treatments such as dips, sprays, etc. prior to display.

Lost shelf life cannot be regained with after-the-fact treatments like washing, dipping in bacteriostatic solutions, storing in modified atmospheric packaging, etc. Likewise, treatments cannot be substituted for poor handling practices or time/temperature abuse. Shelf life is maximized by preventing contamination opportunities and ensuring near 32°F product temperatures continuously during retail stewardship.

Treatments collectively refer to the use of approved methods, technologies, products, or various combinations designed to extend time available to hold, display and sell the product beyond what is available via preventive measures alone. Treatments include various approved product additives, modified or controlled atmospheric storage, use of ozonated ice, bacteriostatic dips and sprays, and organic acid rinses that alter the surface pH. This acid treatment influences the type (and therefore the rate) of microorganism growth. Many of these approaches have been used with other meats for some time. Generally, such treatments are applied at the processing level for three reasons. First, many treatments require specialized equipment. To justify the investment, a high volume of throughput is necessary. Second, some treatments require controlled conditions and specialized labor. Third, treatments applied soon after processing are more effective than the same treatment applied later in the distribution chain.

Importantly though, treatments are not substitutes for preventive measures. To realize an extension in total shelf life beyond what is possible through preventive measures alone, treatments must be used *in conjunction with* preventive approaches. Expressed differently, treatments, in and of themselves, do not protect refrigerated products from accelerated spoilage resulting from time/temperature abuse, contact between microbiologically dissimilar items, or contact between products and insanitary food contact surface.

In a comprehensive laboratory simulation of retail seafood operations, none of the treatments applied to time/temperature-abused seafoods (e.g., lactobacilli inoculum, high-pressure rinse, storage under carbon dioxide, or combinations of these) could match the quality obtained from holding the product at a constant 32°F.[6] Furthermore, none of these treatments prevented rapid spoilage under temperature regimes likely to be encountered when preventive methods were ignored. Likewise, treatments cannot restore lost shelf life (i.e., "freshen" a poor quality product). In other words, if refrigerated products are not of acceptable quality to begin with, treatments applied to extend shelf life become ineffective. Researchers found that fish fillets with high initial gram-negative bacterial populations (resulting from improper post-harvest handling) had a relatively short shelf life even when held under a 100 percent carbon dioxide atmosphere; a treatment that normally results in much longer shelf life compared with storage in "air."[7]

At retail, the best defense against accelerated spoilage is using practices and procedures that minimize opportunities for dissimilar products to contact one another and ensuring continuous, optimally cold product temperatures. Treatments are no substitutes for these good manufacturing practices.

Perishable, Ready-to-eat Seafood Products

Historically, management has not stressed food safety issues in full-service seafood departments because the vast majority of products sold were raw. However, in response to consumer demand for more convenient seafood products, growing numbers of departments are inventorying, handling and even preparing perishable, ready-to-eat foods. Traditional examples include smoked fishery products and molluscan shellfish; either shucked or in the shell. Most full-service seafood departments also fabricate various refrigerated ready-to-eat items such as imitation crab salads. Custom cooking (primarily steaming shrimp, crawfish, lobster, etc.) is an added customer service feature in a growing number of stores. Because of these additions to the seafood mix, food retailers must now address how best to ensure public health across the ready-to-eat product line. This section reviews what is known about food-borne illness, and discusses the tools necessary to minimize product safety threats.

Putting Food Safety and Food-borne Illness in Perspective

The Food and Drug Administration (FDA) indicates that "food-borne illness is a major cause of personal distress, preventable death and avoidable economic burden."[8] Most food-borne illnesses are relatively mild and of short duration. Not surprisingly, such cases typically go undiagnosed and undocumented. On the other hand, outbreaks of severe food-borne illness such as the one involving *E. coli* O157:H7 in undercooked ground beef are startling enough to cause a change in public policy and intensify regulatory oversight throughout the marketing channel. Food-borne illness can be caused by parasites, bacteria, viruses and chemical residues. However, the vast majority of food-borne illness cases (87 percent) is caused by bacterial pathogens.[9]

On-site prepared home meal replacements are a rapidly growing segment of the supermarket industry. Because these products are ready-to-eat, the primary concern is ensuring product safety.

Most food-borne illnesses originating from perishable, ready-to-eat foods do not occur in the home. Between 1973 and 1987, ready-to-eat food sold or served from "retail settings" — restaurants, markets, schools, churches, camps, institutions, and vending locations — accounted for 79 percent of all food-borne illness outbreaks.[10] Historically, most regulatory oversight has been directed at the food service sector because that *was* where most ready-to-eat food was prepared and served. Today, however, FDA cites a blurring between the functions of food service establishments and those of contemporary food retailers, noting that "*Traditional* *differences ... between food preparation/food processing operations in food service compared with retail food stores have virtually disappeared.*"[11] The conclusion to be drawn from this observation by FDA is that regulatory oversight will intensify in those retail departments offering on-site prepared, ready-to-eat items as part of their product mix.

Compromised food safety is a serious concern to both the food industry and the regulatory community. Food-borne illness data offer compelling evidence that no system can be 100 percent problem-free, even with the various overlapping layers of safeguards established by both the food industry and the regulatory community. The fundamental reason why no system can boast of 100 percent success is because the entire marketing channel, from producer to consumer, shares in the responsibility for a safe food supply. Nevertheless, some special interest groups assert that a single food-borne illness is one too many. They demand greater scrutiny of the food industry and hold it responsible for all food safety problems, regardless of cause. As isolated and infrequent as it may be, retailers must recognize that the question is not *if* food-borne illness will occur, but *when*. With that in mind, food retailers must develop programs for ready-to-eat foods that protect public health throughout retail stewardship.

Why Are Ready-to-Eat Foods So Vulnerable to Product Safety Threats?

Earlier it was stated that the entire marketing chain, including consumers, shares in the responsibility for a safe food supply. In general terms, that is absolutely correct. The primary protection against food-borne illness originating from bacterial pathogens is thorough cooking immediately before consumption by the purchaser. Cooking provides an essential safeguard because most bacterial pathogens are extremely heat sensitive. Therefore, even if a raw product harbors a pathogenic microorganism such as salmonella, thorough cooking eliminates the problem. Thus, thorough cooking of ground beef and poultry is an important step in serving safe foods at home. Recently, the USDA required that all retail packages of meat and poultry contain consumer advisories about (a) temeprature control prior to use, (b) how to prevent cross-contamination between raw and cooked meats, and (c) cooked product temperatures sufficient to destroy bacterial pathogens that cause food-borne illness by infection.

Bacterial pathogens like salmonella, listeria, E. coli, etc. are destroyed by thorough cooking. Therefore, preventing bacterial infections is best achieved by thorough cooking *just before* consumption. For raw products cooked at home, the consumer bears most of the responsibility for ensuring product safety. However, when grocers prepare and merchandise cooked, ready-to-eat foods they are responsible for preventing food-borne illness.

However, for perishable, ready-to-eat products sold or served commercially, most of the responsibility for ensuring public health falls on the shoulders of those firms who perform the cooking and subsequently hold the item until it is sold. This responsibility is correctly placed since, with perishable ready-to-eat foods, a key layer of protection — thorough cooking immediately before consumption — is lost.

Other protective layers found in raw seafood products are the characteristically pungent odors generated as these products near the end of

Over time, spoilage bacteria on raw products produce strong odors that suggest the item should not be eaten. However, a ready-to-eat product contaminated with food poisoning organisms (pathogens) often may not exhibit such negative sensory cues.

their shelf life. These obnoxious odors strongly suggest that the item is too spoiled to eat. This sensory protection is lost with a ready-to-eat product since most all spoilage bacteria—responsible for the strong odors—were killed during the cook step. An excellent example of this customary, sensory protection missing in ready-to-eat products is reflected in the National Academy of Science's *Report on Seafood Safety* that states:

> *"The new seafood analogue products [surimi] ... are manufactured from Alaskan pollock and a few other fish species. They are heat treated so that most of the naturally present bacteria are destroyed. This provides a long shelf life under good storage conditions. These virtually sterile products provide an excellent growth medium for contaminant bacteria and do not develop the characteristically unpleasant odors associated with "bad" fish, which consumers use as a warning not to eat the product. Therefore, care must be taken to avoid cross-contamination and warming of such products."*[12]

Ensuring the safety of ready-to-eat foods is best achieved by thorough cooking, preventing post cook contamination, and maintaining appropriate holding temperatures. For refrigerated items product temperatures should be less than 40°F. Items sold in a heated state should be held above 140°F.

Ready-to-eat products can become unsafe through numerous pathways. For example, incomplete cooking may not destroy all bacterial pathogens. Also, cross-contamination between ready-to-eat items and raw products or recontamination of a cooked product with insanitary food contact surfaces such as hands, utensils, trays, etc., may accidentally transfer pathogenic bacteria or viruses onto cooked food. Once a cooked product is handled, improper holding temperatures can facilitiate the outgrowth of bacterial pathogens. Thus, pathogens that remain or are inadvertently introduced after cooking compromise product safety because no further cooking or reheating will occur. *This assumption must be made with ready-to-eat foods.*

If high infective dosages were required for all pathogens, maintaining optimally cold product temperatures would prevent food-borne illnesses caused by bacterial infections. Unfortunately, some pathogenic bacteria like certain salmonella, *Listeria monocytogenes*, *E. coli* O157:H7, and some species of vibrio have relatively low infective dosages. Additionally, some of these bacteria grow well at refrigerated temperatures. Therefore, once a ready-to-eat product is inadvertently cross-contaminated or recontaminated with these pathogens, temperature control alone provides no guarantee against food-borne illness. Also, viruses such as Norwalk (a common stomach "flu") and Hepatitis A do not grow in food but remain infective during low-temperature storage. Thus, all contamination opportunities among ready-to-eat foods must be prevented to minimize public health risks. This would include cross-contamination between raw and ready-to-eat items or recontamination between ready-to-eat products and insanitary food contact surfaces.

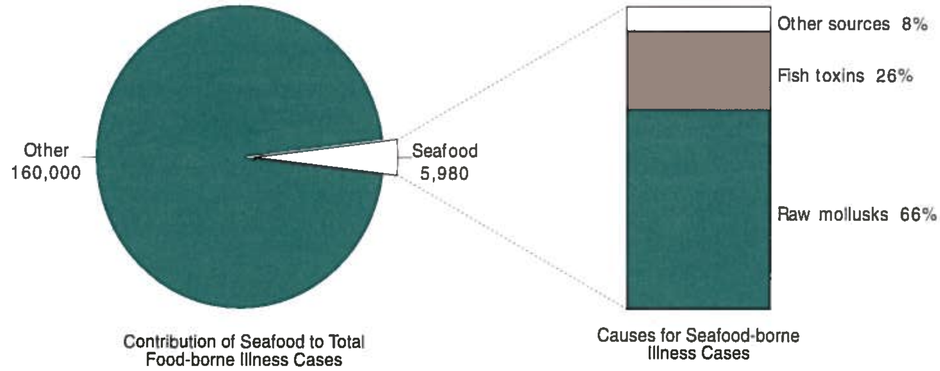

Fig. 3-6. The magnitude and causal agents responsible for seafood-borne illness cases from 1978 through 1987.

A Review of the Contribution Seafood Products Make to Food-borne Illness

The *Report on Seafood Safety* prepared by the National Academy of Sciences notes that most seafoods available to the U.S. public are wholesome and unlikely to cause illness to the consumer. This report further states that although seafood consumption increased by 23 percent between 1980 and 1989, the number of seafood-borne illnesses did not proportionally increase!

In a review of the Centers for Disease Control and Prevention (CDC) data collected for the period 1978-1987, the *Report on Seafood Safety* indicated that seafood accounted for 3.6 percent (5,980 cases) of all cases where the illness could be attributed to a specific food (Figure 3-6, Table 3-1). However, just a "handful" of products is responsible for the vast majority of seafood-borne illnesses.

The vast majority of seafood products are wholesome and unlikely to cause illness. Only a few species — in particular raw molluscan shellfish — are responsible for most seafood-borne illnesses.

Sixty-six percent of all cases (3,941) were attributed to raw molluscan shellfish. Molluscan shellfish comprise most of the seafood-borne illness cases because the entire organism is eaten raw or slightly heated. The bacteria and viruses responsible for these food-borne illnesses are extremely heat sensitive. Therefore, if molluscan shellfish were properly cooked, this source of illness would all but disappear.[13] About 3 percent of molluscan shellfish cases (137) occur from toxins (e.g., paralytic shellfish poisoning, amnesic shellfish poisoning, etc.).

Table 3-1. Causes of Seafood-borne Illness

	Number of Cases Reported to The Centers for Disease Control and Prevention: 1978—1987				
	Toxins	Microorganisms	Chemicals and Parasites	Unknown	Total
Shellfish	137	476	57	3,271	3,941
Fish	1,548	227	61	203	2,039
Total	1,685	703	118	3,474	5,980

The vast majority of these 137 cases however resulted from *recreational shellfish harvesters* since all shellfish-producing states have management plans that suspend commercial harvests when various toxin concentrations reach threshold levels.

Twenty-six percent of all seafood-borne illness cases (1,548) were attributed to various fish toxins. Ciguatera occurs among certain large fishes found in specific areas of the Caribbean or tropical Pacific islands. The other marine toxin is histamine poisoning which results when scombrotoxic species such as mahi mahi, tuna, mackerel, and bluefish are grossly mishandled (time/temperature abused) once caught. Neither of these toxins can be neutralized by cooking.

Seafood-borne illness attributed to bacterial pathogens in finfish accounted for 227 cases, or around 4 percent of total cases. Some of these diseases were caused by the more traditional pathogenic bacteria that include salmonella, *Staphylococcus aureus*, and others. These organisms are derived from terrestrial sources. Therefore, seafoods share the same risk of external contamination as other foods.[14] In 203 cases where finfish were implicated, the cause could not be determined. Finally, chemical and parasitic causes were responsible for 61 finfish cases, just 1 percent of total seafood-borne illness cases.

With the exception of raw molluscan shellfish, the National Academy of Sciences review of seafood-related illness data from the CDC concluded that the number of food-borne illnesses from seafood was quite low. The reason is simple: most bacterial or viral pathogens are quite heat sensitive, so thorough cooking provides an essential safeguard.

The Risk of Food-borne Illness from Full-service Seafood Departments

In retail seafood departments, product safety threats may originate from four primary sources:

- purchasing ready-to-eat items such as molluscan shellfish or crabmeat that are not certified by state/federal regulatory authorities (i.e., bootleg products),
- using improper procedures and practices when handling, inventorying, or fabricating ready-to-eat items,
- incomplete cooking, or
- improper holding temperatures.

Of these four possible threats, the use of improper practices and procedures is, by far, the more significant and widespread.

According to published findings by the CDC, time/temperature abuse is the major factor contributing to food-borne illness of bacterial origin when the illnesses were traced to foods purchased from delicatessens, cafeterias, or restaurants.[15] However, based on audits of full-service seafood departments conducted around the country, temperature control was quite good, although ice-only display equipment typically requires more frequent oversight by employees to ensure low product temperatures.[16] Additionally, retail audit data suggest that, over time, managers have been lowering ambient cooler and display case temperatures as a solution to accelerated seafood spoilage. Specifically, audits conducted in 1991 revealed that the average display case airspace temperature during the sales day was 47°F.[17] During 1993-1994, however, similar measurements around the country averaged 38°F.

Food-borne illness from ready-to-eat products purchased at supermarkets may occur through four primary avenues: (a) purchasing ready-to-eat items — like picked crab meat and molluscan shellfish — from suppliers who are not approved by regulatory authorities, (b) using improper procedures when preparing or handling ready-to-eat items, (c) incomplete cooking, and (d) improper holding temperatures.

In most instances, cross-contamination and recontamination threaten the safety of ready-to-eat products in full-service seafood departments, not time/temperature abuse. Seafood programs are unique among retail meat operations because most departments simultaneously procure, inventory and handle various ready-to-eat marine foods alongside raw products. This creates numerous crossover points where raw items can contact ready-to-eat foods through direct or indirect means. Because repetitive handling is a necessary part of full-service operations, the cross-contamination and recontamination potential is high in these departments. Staffing also contributes to these types of contamination venues because in most departments the same individual must handle both raw and ready-to-eat merchandise. For ready-to-eat products, such handling errors create *permanent* compromises in food safety.

Audit data suggest that various contamination venues — rather than improper cooking or time/temperature abuse — are the major threats to product safety in full-service seafood departments. Contamination potential is high in these departments because one employee typically handles both the raw and ready-to-eat product lines.

Procedures That Minimize Food-safety Threats

No technological "fixes" exist that allow retailers to neutralize bacterial pathogens on ready-to-eat foods or insulate these products from the effects of time/temperature abuse or inadvertent cross-contamination or recontamination. To prevent cross-contamination and recontamination as well as time/temperature abuse the preventive approaches used to maximize shelf life across the raw product line must be used. This would include a parallel idea that all products (both ready-to-eat and raw) are dissimilar. Thus, each must be treated individually, with hand washing or glove changes occurring before a different product is handled. Temperature control is another key preventive measure that must be

Recall that raw seafood products cannot have their shelf life restored by after-the-fact treatments. Similarly, treatments cannot restore safety to unsafe ready-to-eat products. To reduce food safety threats cooking, handling, and holding errors must be prevented.

ensured during retail stewardship. Although some pathogens grow at refrigerated temperatures, their rate of growth partially depends upon temperature.

Preventing these errors requires several common sense elements. One element is the use of color-coded pans, utensils, wrapping films, and gloves dedicated for either raw or ready-to-eat lines. In addition, grocers need to incorporate standard locations for cleaned, sanitized equipment and utensils so that the use of insanitary food contact surfaces is prevented.

To minimize various cross-contamination and re-contamination opportunities, several tools used by the processing sector can be adapted by grocers. An example would be the use of color-coded trays, bags, overwrap films, disposable gloves, utensils and pans as a way to minimize accidental crossover between raw and ready-to-eat products. For example, ready-to-eat foods should be handled only with red gloves, placed on red trays and wrapped in red films.

Another example would be to designate standard locations for cleaned, sanitized pans, utensils and equipment. This would reduce the risk of using an uncleaned, unsanitized pan or utensil. Inadvertently using an uncleaned utensil could result in contamination that may introduce a pathogen onto a ready-to-eat item. Utensils and pans that are repetitively used throughout the sales day for the same function (steamer pans, or utensils used to mix cooked shrimp and spices) should be stored in a sanitizing solution. This simultaneously creates a standard location for routinely used tools that contact ready-to-eat products and ensures that all ready-to-eat food contact equipment is properly sanitized prior to each use. Advisory labels are recommended for ready-to-eat foods — particularly those that are custom cooked and handed off warm to customers. Such labeling would instruct the purchaser to consume the item quickly or refrigerate it.

These preventive measures are the best insurance against compromised food safety. Once these preventive measures are incorporated into a departmental policy and translated into procedures and practices, they become an effective way to prevent food safety from being compromised. Additionally, these preventive measures are highly defensible should questions arise from regulatory agencies or the media.

Conclusions

This chapter has addressed the mechanisms responsible for rapid spoilage among raw seafoods and compromised safety across the perishable, ready-to-eat product line. The raw and ready-to-eat product classes were discussed individually, primarily to make the point that maximizing shelf life is the overriding concern with raw items while ensuring public health is the main issue for ready-to-eat foods. Although the concerns differ by product class, by now it should be clear that the same handling and holding errors create both accelerated spoilage and compromised product safety. These errors are (a) improper handling that results in two microbiologically dissimilar items contacting with one another or a food product contacting an insanitary food contact surface and (b) time/temperature abuse of products. In addition to these common handling and holding errors, products that are not thoroughly cooked on-site may be unsafe, regardless of subsequent handling and holding procedures.

Various improper handling methods result in the transfer of high bacterial loads onto product surfaces. "Newer" products may come into contact with "older" ones when employees move products from one step in the retail inventory cycle to another, process items into more convenient market forms, etc. This can occur directly when one item touches another or indirectly if employees do not change gloves or wash their hands between handling different products. Similarly, when products contact uncleaned food contact surfaces like pans, countertops and utensils, bacterial loads are also transferred to product surfaces. Cross-contamination occurs when a ready-to-eat food comes in contact with a raw item. This can also be through direct or indirect means (i.e., via an employee). Any sort of contact may add materially to the bacterial load already present on a perishable item thereby requiring fewer generations (and less time) to reach threshold spoilage levels (Figure 3-2, page 21). Likewise, pathogenic bacteria or viruses **may** be introduced onto ready-to-eat foods through the same contact venues. Some pathogenic bacteria can induce illness at very low infective dosages. Therefore, any cross-contamination or recontamination event may permanently compromise product safety.

Time/temperature abuse compresses the interval necessary for a given number of bacteria to double. With raw products this shortens time available to sell them because less time is necessary for spoilage bacteria to reach threshold levels (Figure 3-3, page 23). Among ready-to-eat foods, time/temperature abuse creates conditions that are ideal for rapid growth of many pathogenic organisms. Therefore, allowing ready-to-eat foods to exceed proper holding temperatures heightens the possibility of foodborne illness by increasing the abundance of pathogens.

If the same errors create both quality and safety problems, then the handling and holding requirements that minimize accelerated spoilage among raw products will also ensure the safety of refrigerated, ready-to-eat seafoods. These handling and holding requirements are the foundation of an operational strategy that strives to prevent quality and safety errors. Such a strategy should incorporate the following components:

- minimize contact among microbiologically dissimilar products and minimize contact between products and insanitary food contact surfaces by:
  - washing hands or changing gloves when handling contents from different containers,
  - keeping previously displayed merchandise separate from that portion of the container that remained in refrigerated storage and
  - using cleaned, sanitized, color-coded equipment procured from standard locations to prevent cross-contamination or recontamination of ready-to-eat products,
- maintain constant product temperature as close to 32° F as possible, and,
- periodically clean and sanitize both food and non food contact surfaces to control the abundance of microorganisms.

Admittedly, the preventive approach is rudimentary when compared with technological innovations such as modified and controlled atmosphere packaging, bacteriostatic dips and rinses, etc. However, two key points underscore the importance of operational plans that prevent handling and holding errors. First, no after-the-fact treatments applied to inventory that has been time/temperature abused or improperly handled can recapture lost shelf life or restore product safety. Second, no technological treatments can protect perishable inventory from the permanent effects that result from either time/temperature abuse, or when microbiologically dissimilar items contact one another, or when products contact insanitary food contact surfaces.

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Chapter 4

How to Improve the Management of Quality and Safety in Full-service Seafood Departments

Overview

Chapter 2 argued that a well-conceived, research-based quality and safety management plan simultaneously allows the firm to maximize the upside potential of a full-service perishables department and minimize the downside risk. Such a plan directly contributes to three interrelated goals:

- meeting profitability targets without dramatic increases in either sales volumes or gross margins;
- minimizing the threats that originate from unsafe ready-to-eat foods;
- maintaining a defensible position in an environment of heightened scrutiny of the food industry by regulatory authorities and an opportunistic media.

Given the importance of these goals to sustained performance, most would conclude that management of quality and safety is an important new function for retailers committed to full-service perishables departments.

However, retailing a safe, fresh, long-lasting product mix is no more automatic than successfully expanding into new trading areas or financing operations with the least cost and risk. Sharp reductions in both accelerated spoilage and the possibility of compromised product safety are the results of a management process that translates general concepts, principles and policies into specific work plans that can be carried out by departmental employees. As discussed in Chapter 3, remaining shelf life is maximized and safety is ensured by preventing handling and holding errors, not treating them.

This chapter is about the process of improving performance. For retail perishable departments, improved performance means reducing avoidable shrinkage and ensuring the safety of ready-to-eat items. Initially, the process of improving performance across all industries is summarized, and its track record examined.This general discussion provides the framework for a more detailed examination of how the quality and safety improvement process for full-service seafood departments was approached.

A Review of the Quality Management Process

Management of quality has changed over time. Historically, managers viewed quality as something to be controlled. Today however, corporate policy makers recognize that quality is linked to basic business objectives

With traditional quality control programs "spike" defects were the main focus.

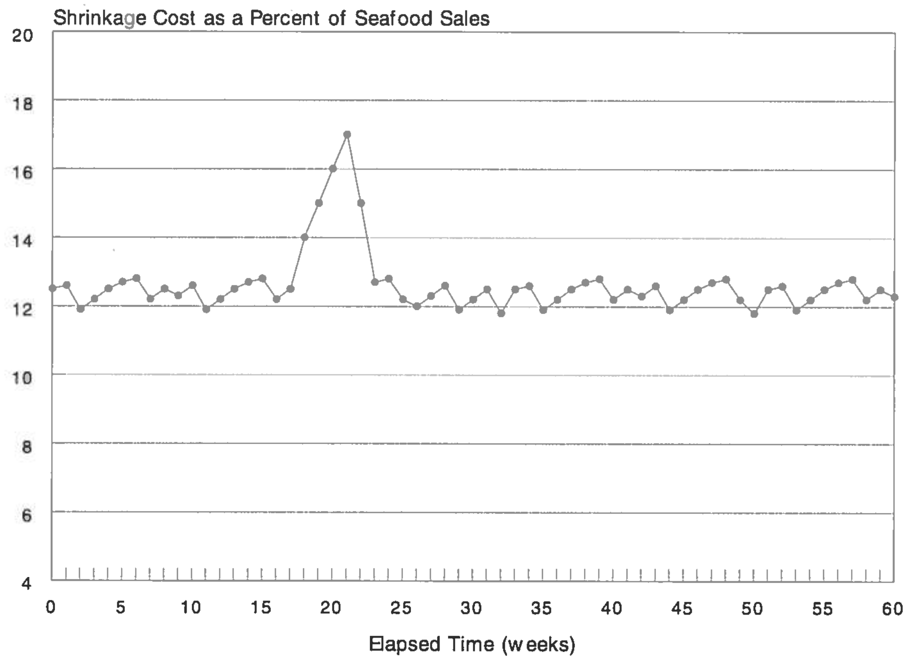

Fig. 4-1. Performance realized under traditional quality control.

thus making it another component of the firm's competitive strategy.

Through time, management of quality has become more comprehensive, and more functional elements of the firm's operation have been scrutinized for the impact each makes on ending quality. Quality control, a classic functional element incorporating inspection and end-product testing, has existed for hundreds of years. Alternatively, quality improvement is a relatively new idea that seeks unprecedented levels of performance. The goal of contemporary quality improvement in manufacturing is to shift attention from the end of the production line, where finished goods not meeting quality or safety standards are separated, to one of designing quality and safety into products through a comprehensive, stepwise procedure.

Managing quality historically involved sorting finished products that met specifications from those that did not. This approach still occurs in retail perishables departments each morning as employees separate merchandise deemed saleable from that which must be discarded. While this procedure keeps substandard merchandise off the shelves, it does nothing to reduce the "baseline" costs of shrinkage that result from accelerated spoilage.

Historically, maintaining quality at predetermined levels was seen as the best achievable goal. In fact early references to quality control suggested it was the approach used to "keep things from getting worse."[1] When quality was considered as something to be controlled, many quality management programs were considered successful when sporadic problems, such as the spike illustrated in Figure 4-1, were fixed and the level of defects, scrap, shrinkage, etc. could be returned to traditional levels.[2]

Over time, various quality managers began exploring ways to go beyond current expectations and actually improve baseline quality. Much of the motivation for improving quality has been derived from the costs of poor quality. As seen in Figure 4-1 the large, chronic waste represented by the area under the curve represents a significant, partially avoidable cost; *even without the spike.*

Simply maintaining historic shrinkage levels is no longer sufficient. In the competitive food retailing game finding ways to reduce avoidable costs like accelerated spoilage proportionally increases departmental contribution to store overhead.

As various industries have become more competitive, attempting to ensure sustained economic performance without addressing the role that improved quality can play on both the cost and demand sides generally requires solutions that most firms cannot achieve. The grocery industry is a case in point. As Chapter 2 illustrated, predicating economic success on selling more will require enormous increases in weekly sales volumes at a time when aggregate per capita consumption of all meats is growing at a sluggish rate. Similarly, charging more is a difficult undertaking in most trading areas because competition imposes ceilings on the selling prices of commonly available items. Therefore, maintaining historic shrinkage levels is no longer sufficient for the grocery industry. On the other hand, if these chronic, avoidable costs are reduced, contribution to store overhead will proportionally increase given that other factors in the retail pricing equation remain constant.

The goal of quality and safety improvement is to create unprecedented levels of economic performance over time. On the cost side, this is achieved by systematically reducing the volume of spoiled, discarded product. At retail this means reducing accelerated spoilage. Three main steps are necessary to boost performance.

- Management must determine where in the operation quality and safety errors occur, and why. This is best done through some type of review process whereby current operations are evaluated against a predefined set of criteria.
- Once these errors are identified and categorized, new procedures (properly sequenced practices or steps) must be established. When correctly implemented by workers, these new procedures will minimize or eliminate the errors uncovered in the previous step. The development or adaptation of these tools is frequently referred to as "doing the right things."
- Planners and designers must ensure that the new, specified procedures can be properly carried out by current departmental personnel. This ensures that performance gains initially realized are subsequently sustained over time.

Upon completion of these three steps, the effects of the quality improvement process manifest themselves (Figure 4-2).[3] With a new procedure set in place, shrinkage is controlled at a lower level (about 8 percent of seafood sales) but with some unavoidable variability (i.e., shrinkage costs still fluctuate through time). This variability suggests that undertaking a performance improvement program does not pre-empt the need for routine management. Once the "new" task set is determined, the firm will need to establish a program to ensure that the improved level of performance is sustained.

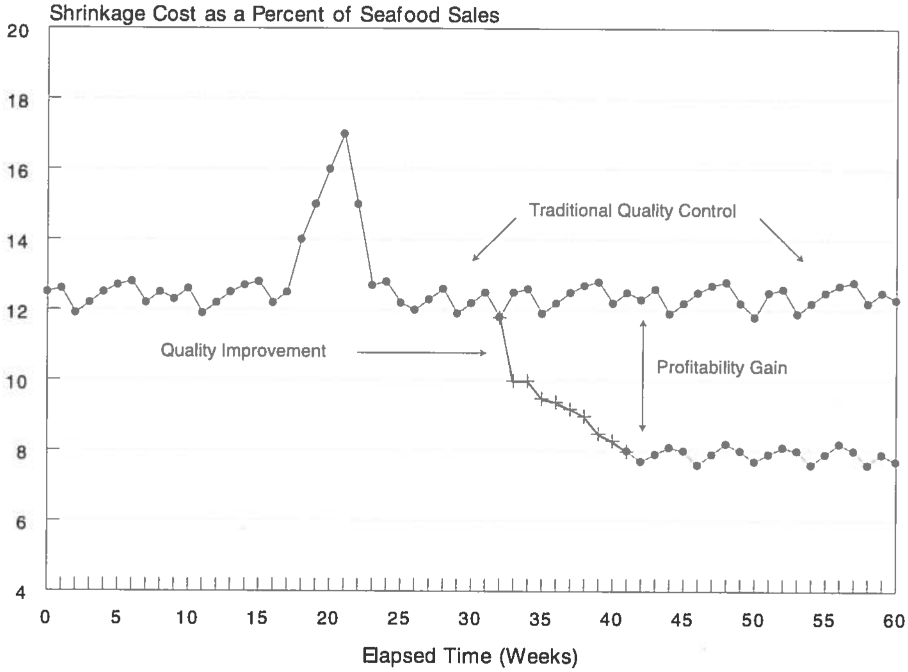

Fig. 4-2. The performance difference between quality control and quality improvement.

With an upgraded procedure set in place, less product is discarded and profitability proportionally increases.

The primary steps used in quality improvement are conceptually simple and logically sequenced. Therefore, quality improvement programs should be routine undertakings with sustained gains in economic performance virtually guaranteed. However, the data collected across the spectrum of American business and industry suggest a different, less certain track record. In fact, quality improvement remains a formidable challenge to management that frequently ends in failure.[4]

While there may be few winners in the quality improvement game, much can be learned from them. The first observation is firms that have boosted their performance by improving quality have no underlying philosophy, knowledge, or information that is different from those that have been unsuccessful.[5] Thus, the difference between successful and unsuccessful firms cannot be explained by a technological or informational advantage. This finding troubles many managers because it refutes the long-held belief that investment in new technology is a precursor to improved quality. Some researchers suggest that progress toward improved quality has been painfully slow precisely because many search for technological solutions to management problems.[6] New technology is obviously important in improving performance, but technology alone usually does not provide a complete solution. For instance, retailers have invested in low temperature display cases that can maintain optimally cold product temperatures. However, handling errors can still compromise product quality and safety. These errors must be corrected by management plans, not new technology. The second observation is that firms successful with quality improve-

Audit data suggest that accelerated spoilage and compromised product safety result from handling errors — not time/temeprature abuse. Therefore, reducing these costs requires a managerial solution, not investment in new technology.

ment projects have done so by linking commonly known principles and guiding philosophies with day-to-day events. This linkage is established by "translating" philosophies, concepts, policies, and principles into executable plans (i.e., sets of properly sequenced practices) which workers can use to do their jobs. These executable plans document what should be done, and precisely how to do it. All procedures seek to answer a question posed by an employee: *"What would you have me do differently from what I am now doing?"*[7]

Steps Required to Improve Retail Quality and Safety Management Procedures

The retail seafood department offers a challenging venue for improving quality and safety management procedures because it embodies both of the previous observations about what is and is not consequential to successful quality improvement activities. (Recall that improvements generally result from managerial changes that translate general philosophies and concepts into executable plans which workers can use to do their jobs.) For example, Chapter 3 demonstrated that a safe, fresh, long-lasting product mix is the end result of a rudimentary, even simplistic, strategy that prevents quality and safety errors during retail stewardship. The elements of this strategy are widely known throughout the retail community, and have been for many years. In particular, sharp reductions in accelerated spoilage and compromised product safety are realized only when departmental personnel *simultaneously*:

- maintain low product temperatures;
- use appropriate handling practices so that various contact opportunities are minimized, either among microbiologically dissimilar products or between products and insanitary food contact surfaces;
- ensure that those products with the least amount of remaining shelf life have the first opportunity to be sold;
- periodically clean and sanitize all food contact environmental surfaces to reduce the abundance of microorganisms.

To reduce avoidable shrinkage and the opportunities to compromise product safety, perishable products must be kept "cold, clean and moving" during retail stewardship. These objectives have been common knowledge among grocers for at least fifty years. However, meeting these objectives requires that they be translated into a set of procedures that define how to perform each of the various activities necessary in full service operations.

Translating these objectives into step by step procedures requires two primary functions. First, corporate management must determine where handling and holding errors occur. Second, scientifically validated procedures must be designed that can be carried out by current personnel.

If all of these criteria are not satisfied across every function that retail seafood departments routinely undertake, remaining shelf life can be rapidly consumed across the raw product line, and otherwise wholesome, ready-to-eat foods may become unsafe.

While the four-pointed strategy itself is common knowledge, the challenge for quality and safety improvement is vast. The four elements of the

Handling mistakes are the more common types of errors expected in full service departments since the same employee handles a microbiologically dissimilar line of raw and ready-to-eat items. As such, he becomes the crossover point for literally hundreds of contamination opportunities in a single day.

preventive strategy must be translated into a set of executable plans that must factor in the day-to-day operating conditions found in retail service departments. Yet, full-service seafood departments are among the most complex operations in the entire food industry. This makes the process of improving quality and safety management more complex too. In fact, typical operational mandates often derail efforts designed to prevent quality and safety errors. For example, most employees understand that disposable gloves must be worn when selecting and weighing products for customers. This is a basic idea that prevents direct or indirect contamination through employee hands. However, in most retail departments the same employee who began steaming shrimp for one customer must break away from that task to select and weigh an order of raw products for another patron, only to return to the cooking operation. If the employee did not change gloves between his handling of the raw product for customer B and the cooked shrimp prepared for customer A, cross contamination occurs which may compromise the safety of cooked shrimp. Because the same person handles a microbiologically dissimilar line of raw and ready-to-eat items, he becomes the crossover point for literally hundreds of contamination opportunities in a single day. Likewise, employees are pushed to keep the department open until a predetermined time; yet, management of labor cost requires them to be "off the clock" soon after closing. Without a litany of essential tasks to complete upon closing, some key work either falls victim to the time clock and is not completed, or some procedures are completed improperly as employees rush to finish the closedown process within the time allowed. Such omissions or improper techniques set the stage for widespread, accelerated spoilage among raw products and boost the chances of compromising the safety across ready-to-eat foods. These types of operating conditions—though normal—create obstacles for designing a management system that can improve performance.

In addition, the grocery industry has been largely left to its own resources to improve quality and safety with a preventive strategy without two key pieces of the quality improvement puzzle. The first of these is knowing precisely where quality and safety are lost during retail stewardship ... and why. Obtaining such basic information requires a significant time commitment from management. Because numerous functions are carried out in retail seafood operations, learning where and why quality and safety errors occur requires an in-store examination of how employees perform the varied tasks required during the sales day. Assessing how the various practices and procedures affect quality and safety provides obvious benefits. Yet, managers could conceivably spend several days observing a single department to pinpoint a single instance—that took no more than several seconds—where an employee accidentally allowed two microbiologically dissimilar items to contact one another. With managerial resources already stretched within the food retailing community, the commitment of time necessary to evaluate relatively small but complex operations like full-service seafood has, understandably, been given low priority.

The second information gap is knowing what can be done differently to prevent the identified errors from recurring. Assuming that management found particular points where quality and safety errors were made, they must then recommend different approaches or procedures that correct problem areas. Virtually nothing has been published which summarizes how well various retail procedures meet the requirements of the preventive strategy. This places the grocer in a position of having to choose or recommend a particular practice or procedure without knowing anything about its expected performance. The product washing step is the single best example of a procedure being mandated without knowing the expected result. This procedure surfaced in the early eighties as retail management attempted to reduce accelerated spoilage. Laboratory evaluation of this procedure on skinless fillets confirmed that no sustained shelf life or sensory benefits were derived from washing, even under *ideal* handling methods.[8] Unfortunately, the way that most retail employees approach this time-consuming task systematically inoculates fresher merchandise with the bacterial load from an older product and contributes to accelerated spoilage. Yet, the procedure persists because no evidence has been presented to the contrary.

Little can be done to alter the complexities of the retail environment because competition is the controlling factor. With respect to the product mix, grocers will continue to merchandise a wide, diverse line of raw seafood products for the foreseeable future. Likewise, retail management will continue to expand the mix of ready-to-eat products to meet growing consumer demand for such convenience.

However, both the sources of quality and safety errors and specific ways to prevent their occurrence can be addressed thereby providing retail management with a point of departure for creating their own quality and safety management systems. The remainder of this chapter reviews the approach used to explore where and how quality and safety were lost during retail stewardship. Additionally, criteria used to reconfigure and redesign procedures are outlined so that, when carried out by existing personnel, quality and safety errors can be prevented.

Step One: Assessing Where Quality and Safety Are Compromised in Current Operations

To determine the sources of quality and safety errors, the entire retail inventory cycle; all ancillary functions such as cleanup and sanitation; and layout and use of the physical plant, etc. must be scrutinized. The retail inventory cycle (Figure 2-2, page 7) is comprised of passive steps along with various handling activities. When a passive step or activity compromises quality or safety, it must be changed.

Passive steps—points where the products remain in an undisturbed state—include storage and display. The obvious quality and safety error expected here would be abusive product temperatures during the holding period that would lead to rapid consumption of remaining shelf life. The

Full-service operations include the two passive steps of storage and display along with numerous activities. Improper temperature control is the error expected in a passive step while some type of handling mistake would normally occur during an activity. Both holding and handling errors create permanent, lagged effects.

effect various combinations of equipment choices, display options, and ambient case air-space settings have on product temperature during display and thus shelf life consumption rates has been evaluated. Some 200 separate performance trials were conducted with the objective of providing retail management with display strategies that are consistent with the expected case residence times of perishable inventory. This information is summarized in Chapters 5 and 6.

A distinguishing factor of full-service seafood departments is continuous handling of products until they are sold or discarded. In addition to daily setup and breakdown of display cases, most departments fabricate or prepare ready-to-eat foods and custom cook (steam) for customers. These routine, daily activities further increase the number of times an individual product is handled. The primary quality and safety error that results from handling is a transfer of high bacterial loads from (a) microbiologically dissimilar items contacting one another or (b) products contacting insanitary food contact surfaces. The retail inventory cycle is mostly comprised of such activities; thus, the activities themselves pose the greatest threat to quality and safety. Because errors in handling products can occur instantaneously, activities are best evaluated by in-store observation instead of laboratory simulation.

The In-Store Quality and Safety Audits

To assess the full scope of activities necessary to complete the various functions associated with full-service seafood departments, a standardized quality and safety audit was conceived, designed, and implemented among cooperating food chains between June 1993 and April 1994. The objectives of the audit process were to:

- examine precisely how the various retail functions were completed;
- generate temperature histories of products throughout the retail inventory cycle and relate these to specific handling procedures and practices;
- check for consistency in procedures and practices used across the chain.

The information generated from the audits is best characterized as a series of in-depth studies. The same type of information was collected in each store. This served as a basis for making more general industry-wide assessments of what was done during retail stewardship and how these tasks were accomplished. Above all, the audits are neither "finger pointing" nor critiques of individual activities. These standardized quality and safety audits are objective fact-finding exercises designed to provide management with key information about: (a) those practices and procedures that the audit team deemed "best in the business" that should be shared throughout the firm and (b) those practices and procedures that needed to be eliminated, changed, or added because all four preventive objectives were not met.

In the quality literature, audits of a firm's quality and safety program generally begin by evaluating the written quality/safety plan. This phase of the audit determines whether the plan, when implemented, can meet expected results. In other words, it judges whether the "right things are done." The second phase of most quality audits entails evaluating actual "factory floor" implementation of this written plan. This step determines whether the written plan was implemented according to specification.

The standardized quality and safety audits of retail seafood departments differed from quality audits conducted in manufacturing operations where written quality plans are routine. Such plans seldom exist within food retailing. Most often, departmental reference manuals are compendia of seafood-related topics useful in answering consumer questions. Such materials typically do not outline how to implement elements of the preventive strategy (i.e., the steps required to ensure proper stock rotation sequences, maintain optimal product temperatures, minimize various product contact venues, complete cleanup and sanitation tasks, etc.). Because no written plan existed, an initial task of this fact-finding exercise was to design a standard approach that would both specify the information needed and facilitate the consistent, systematic collection of it by study team members across all cooperating firms and stores.

The standardized quality and safety audits enabled auditors to "drill down" into departmental operations, and separate an otherwise seamless set of activities and events into specific functions. These functions included:

- evaluations of incoming products by departmental personnel;
- practices and procedures used to make the department operational in the morning (e.g., the methods used to prep products before placing them in the display case and the methods by which the display case was stocked/restocked);
- the repetitive steps between receiving inventory and selling or discarding it;
- the mechanics of filling customer orders;
- the approach used to differentiate:
    - various shipments from one another and
    - contents of the same container, some of which were removed from the container and displayed, but remained unsold at day's end while the remainder was held in storage since receipt,
- management of refrigerated and ice-only display environments;
- fabrication and holding of perishable, ready-to-eat foods;
- the approach used to select, stage, cook, season, and package products on demand;
- cleaning, sanitizing, and personal hygiene.

Across each function the entire slate of practices and procedures was observed. In particular, the audit team noted what was done, precisely how it was done, when it was done, and by whom (i.e., by department manager or a parttime employee). The primary objective was to decide

A standardized quality and safety audit of retail seafood departments was conducted to learn where in the retail inventory cycle quality and safety errors occurred. Subsequently, a series of procedures was developed to correct these errors.

whether the preventive strategy goals were met.

Each departmental audit began before employee arrival and ended after the department was closed and the employee(s) left for the evening. One study team member was stationed in each store over the three-day audit period. The evening prior to the first audit day, a battery-powered temperature recorder was installed in each display case to record ambient case airspace temperature over the course of the audit. Additionally, each observer generated a temperature history of the product line as it traversed through the retail inventory cycle—during storage, before and after prep if applicable—and about every two hours while the product line was on display.

Findings From Standardized Quality and Safety Audits

Findings that affect a particular function are outlined in subsequent chapters. The following section addresses some more generic quality and safety management issues with the objective of further developing the argument for a more standardized approach to management of quality and safety.

Retail firms participating in the audits had vastly different operating characteristics with respect to product mix, customer interest/demand, employee expertise, training regimens, documentation about standard operating procedures, etc. In addition, some retail firms were literally minutes from major production regions and shore-side processing facilities while other firms relied on products shipped great distances. Despite these operational differences, auditors found that most firms used about the same approach in managing quality and safety. Furthermore, they discovered greater differences in what was done and how it was completed among stores in a given firm than across disparate chains.

None of the cooperating retail firms had **defensible** quality and safety management plans; that is, plans specifying stepwise procedures that outline what to do at each functional step, and precisely how to do it. Without a written plan, it is no surprise that auditors discovered significant differences in not only what was done in each store of a cooperating firm (i.e., product prepping, maintaining identity among the same species with different amounts of shelf life remaining, etc.) but also how tasks were completed. This finding is consistent with the initial concern that without a set of standard operating procedures many seafood departments use untested procedures developed by employees. Several of these "common sense" practices sometimes depreciate product quality as opposed to maintaining it. Such findings suggest that not implementing an effective, efficient standard operating procedure may be the root cause of current quality and safety management problems within full-service seafood departments.

Despite the lack of written plans, however, departmental employees have created some "best in the business" procedures that are both effective and failsafe. For example, auditors in one store observed that as products were delivered, the market manager placed each product on a large styrofoam meat tray, wrapped it, then, using an indelible marker, labeled it by species with the date of delivery. This formed the basis for an accurate, fail-safe method of rotating products received first. Unfortunately, this practice was not replicated in any other store audited within that firm. Thus, there appeared to be no mechanism for transferring an efficient, effective practice throughout the chain. Importantly, this is a management function since departmental personnel are hired to work in individual stores, manage the time of their employees, and handle the ordering.

On the other hand, auditors frequently observed the same incorrect procedures being used in other stores of the same chain. While this too is a management responsibility, holding management accountable is difficult since retail procedures have not been scrutinized and scientifically evaluated. The sources of the practices were varied. Some were mandated by management, while others have evolved from "common sense" approaches that the employee believed were appropriate.

Auditors also observed that market personnel, market managers, and district managers frequently overlooked numerous subtleties required to provide safe, fresh, long-lasting products to customers. Three cases in point are:

- the improper use of detergents and sanitizers;
- cross-contamination of a cooked-to-order item by returning the cooked merchandise to the bag used to weigh a raw product;
- using insanitary utensils to mix or serve ready-to-eat items.

When these practices were brought to the attention of management, some responded by saying they would "generate another memo" spelling out the approach market personnel should follow. This is not intended as criticism of management, but suggests that building operational plans for managing quality and safety within full-service departments has typically been an additive, crisis-driven process, characterized by applying one approach over another to the point where no structured, defensible system exists. Importantly, the existing system in many firms cannot even be evaluated by management since nothing is standardized among stores.

The lack of research-based, streamlined standard operating procedures does not imply that retail seafood operations per se' present products of questionable quality or safety. Rather, it suggests that the current system needs to be refocused with a standardized method for managing departmental operations. This approach should: (a) use a comprehensive but simpler approach that can be readily evaluated for compliance, (b) provide correct on-the-job training for new people, and (c) be defensible should quality or safety questions arise.

Step Two: Designing Effective, Efficient Procedures and Practices That Correct Quality and Safety Errors

The standardized quality and safety audits generated a rich information source about what activities were typically performed at retail and how

Each procedure was evaluated for its effectiveness in keeping products *"cold, clean and moving."* Two other design criteria were also key to standard operating procedure development — ease of understanding by departmental employees, and time efficiency to complete. These two criteria are important because service department employees have other responsibilities besides managing quality and safety.

they were completed. Each practice and procedure was evaluated for its effectiveness in meeting elements of the preventive strategy. On the one hand, several procedures and practices could not meet any of the objectives in the preventive strategy; even if correctly completed. Furthermore, these procedures were time consuming to implement and, if done improperly, had significant downside effects on product quality. Of course, such procedures should be *eliminated.* By far the greatest number of procedures and practices were a necessary part of retail operations, but at least one element in the preventive strategy was violated.These practices and procedures need to be *restructured* so that all elements of the preventive strategy were met. Next were practices and procedures that — as observed — met all preventive strategy guidelines.These should be *kept*. Finally, some essential steps were not completed.These must be *added* to the list of required activities.

All workers have additional jobs besides maintaining quality and safety. Thus, improving performance should be viewed as creating a more effective way to work, not simply adding another functional element like management of quality and safety to complete along with other tasks.

While improving performance begins with an effective plan, actually meeting performance expectations depends upon whether the plan is implemented as specified. A plan that specifies the right things but cannot be carried out by the employees returns no performance gains. The capability of labor to implement practices and procedures is obviously important, but often overlooked in the quality improvement game. All workers have additional jobs besides maintaining quality and safety. Thus, improving performance should be viewed as creating a more effective way to work, not simply adding another functional element like management of quality and safety to complete along with other tasks.

Improved performance is realized only when a plan is designed that specifies the right things, and is subsequently implemented by workers according to specification.Therefore, the plan must also be designed so that the chances for proper implementation are maximized. Yet, the retail department has many things working against proper implementation. First, most work is done without direct supervision, and some departmental employees begin their work with little food handler experience. Second, the department maintains a wide, microbiologically dissimilar mix of products.This condition heightens opportunities for numerous contact venues because the same individual is responsibile for all functions with the entire product line.Third, quality and safety errors can occur instantaneously but the effects manifest themselves over time. Thus, unless an error is caught when it is being made, responsibility cannot be established. Fourth, those items subjected to improper handling or holding practices are not segregated from unaffected products so the effects of handling or holding errors often become magnified across a greater proportion of the product mix.

An important question is "What assurances can be built into a new system so that the plan will be carried out as written?" Additional management oversight is not the answer first because of cost, and second because some errors, such as accidental inoculation through contact, can be made in seconds. This would require continuous management oversight. Thus, management has no effective way to make sure the plan is correctly implemented; *except through design*.

Therefore, a second phase of plan design is considered which seeks to structure practices and procedures so that they have the greatest probability of being correctly implemented. To minimize avoidable shrink and ensure the safety of ready-to-eat foods, all practices and procedures must be designed around three other implementation criteria while meeting the four elements of the preventive strategy outlined on page 41.

- Procedures and practices must be simple to comprehend.
- They must be time-efficient to implement. Procedures that require excessive time to complete are good candidates for a *freelance* approach in which the operator takes certain short cuts to ultimately depreciate quality or compromise safety rather than maintaining it.
- Where possible, the practices and procedures must provide feedback to the staff about whether they are doing things the correct way.

Plans also need to be pared down to the fewest steps possible. One way to reduce the number of steps is to search for all redundancy with other processes and steps and eliminate it. When redundant steps are found, corporate planners should choose the step that takes the least amount of time and has the least opportunity for handling errors. Specifically, when a passive step can be substituted for an activity it should be done because the passive step is always easier, cheaper, more productive, and less prone to handling errors than an activity. For example, one argument made to continue the "washing" step is its effect on chilling inventory before displaying it. Yet, auditors found that products exit the storage cooler at close to optimally low temperatures (a passive step). To chill inventory with an activity such as washing obligates the employee to a significant amount of time to achieve something that is better done through passive means (i.e., holding under ice in refrigerated storage).

The design stage is, by far, the most challenging step in the quality improvement process because the plan itself must satisfy many technical criteria. This often requires designers to (a) sift through numerous alternatives or (b) devise new approaches. Therefore, designing ways to improve the management of quality and safety becomes difficult because — paradoxically — the end result has to be effective, yet simple.

Conclusions

A wide mix of unique products comes together in most full-service seafood departments. Those working in seafood departments handle a diverse product line, and do more with it than their counterparts in meat departments. For instance, meat operations focus on preparing ready-to-cook retail cuts from either subprimals or converting one market form to another (e.g., steaks to cubed beef to ground beef). Conversely, seafood department personnel not only merchandise a variety of seafoods, each with a different amount of remaining shelf life, they also prepare and handle various ready-to-eat items. Given a unique shelf life among different species and the heightened food safety risks implicit with on-site prepared, ready-to-eat items, a strong case can be made for a standardized approach in retail operations which: (a) simplifies processes, (b) utilizes a research-based "recipe" approach in completing tasks, and (c) provides periodic training of these principles. Unfortunately, such an approach may be the exception among most retail seafood departments.

Four objectives must be addressed to market safe, fresh, long-lasting products through full-service departments. First, the interactions among products, workers, and food contact surfaces must be managed to prevent accidental contact that leads to accelerated spoilage of raw products or may compromise the safety of ready-to-eat foods. Second, the passive steps must employ stocking procedures that ensure constant low product temperatures. Third, procedures must be designed so that inventory with the least amount of remaining shelf life is positioned to exit the department first. Fourth, all food contact surfaces must be periodically cleaned and sanitized to reduce the abundance of microorganisms.

Each four considerations focuses on the practices and procedures used by employees. Therefore, human skill and knack are necessary to reach quality and safety targets in full-service departments. Expressed another way, minimizing accelerated spoilage and ensuring the safety of ready-to-eat products is linked to employee management, not the application of technologies. There are two primary reasons for this. First, full-service departments are predicated on intensive, repetitive handling of the product line between receipt and sale or discard. Second, sharp reductions in both accelerated spoilage and the probability of compromised food safety result when errors are prevented.

Importantly, sustained quality improvement only occurs when plans meet two objectives. On the one hand, all plans should be based on the preventive strategy. Procedures that specify how to complete a given task should be based on performance proven through scientific validation. Yet, a plan that just satisfies the product-oriented criteria is half complete since real improvement happens only when labor carries out the plan according to specification. Therefore, quality and safety management plans must also respect the limitations imposed by labor. Thus, each procedure should be crafted so that opportunities for careless actions, inadvertent mistakes, or omissions of key steps are sharply reduced or eliminated. Because of limited managerial oversight in most retail settings, management must design procedures that are so simple that not following them results in more, rather than less, work.

A set of standard operating procedures (SOPs) designed for each function would give structure to the various departmental tasks, and reduce the opportunities for accidental mistakes or omissions that compromise quality and safety. Furthermore, standard operating procedures would help in the development of those positive, human knacks that are so essential to sustained quality and safety improvements in service departments. Finally, the development and use of SOPs provide an excellent defensible program. Such activities are key to retail Hazard Analysis Critical Control Point (HACCP) programs too. Specifically, the four broad categories that retail HACCP must consider are: (a) developing product specifications, (b) certifying or qualifying vendors, (c) adapting and carrying out in-store processes, and (d) communicating with consumers through advisory labels, etc. Of these, the greatest challenge to management is perfecting the in-store processes.

The food retailing community is not alone in its need for effective, simple procedures. Across all industries, deficient operational processes are the single, most common reason for poor quality (i.e., high levels of waste or shrink, various manufacturing defects, etc.). Building research-based, workable procedures to combat quality and safety errors and putting them in the hands of employees is a significant management challenge, but it offers the richest economic rewards for those firms committed to finding and implementing solutions. Because improvements in quality and safety are dependent upon linking procedures and practices with day-to-day events through the creation of executable SOPs, it offers progressive firms an immediate comparative advantage over others since such management plans are difficult to duplicate.

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Chapter 5

Product Display

Overview

Historically, the display objective in service seafood departments has been to maximize eye appeal by constructing attractive product presentations. While eye appeal is a key merchandising objective, there are other equally important considerations within the display function that fall under quality and safety management. For instance, regulatory mandates designed to ensure public health must be incorporated into the department's display strategy. These mandates typically specify the separation of raw and ready-to-eat products to avoid cross-contamination. The display function should also incorporate three other objectives that reduce opportunities for avoidable spoilage. First, both direct and indirect contact should be prevented, either among microbiologically dissimilar products or between products and insanitary food contact surfaces. Second, low product temperatures must be maintained during case residence time so that remaining shelf life of all products can be maximized. Third, with each SKU, products with the least amount of remaining shelf life need to be positioned to sell first.

Traditionally, product display is viewed as a static event; yet, meeting *each* of these display objectives requires numerous activities such as loading the case in the morning, selecting a product for customers throughout the day, and undertaking some type of closedown procedure at day's end. The way these activities are designed and implemented can have a significant impact on product quality and safety, as well as on labor productivity, given that even the fastest turning inventory items are handled at least twice in service operations. Properly designed and implemented activities are essential to success in the display function. ***Even if every objective related to presenting and holding products is met — like ensuring physical separation between raw and ready-to-eat products and maintaining low case airspace temperatures — so long as the activities used to load, sell from and unload the case are improperly designed or implemented, departmental performance will stagger under high levels of avoidable spoilage or perhaps the shadow of unsafe ready-to-eat products.***

The display function is perhaps the most challenging element of overall retail operations management for several reasons. First, several different goals converge at this function. The best examples of two divergent goals are eye appeal and maintenance of shelf life. Often, maintenance of shelf life (ensuring low product temperatures) is traded off so that eye appeal can be maximized. In situations where products remain on display less than four hours before they are sold, such a tradeoff is generally appropriate. However, when products cycle between storage and display for one to two days before they are sold, increased shrink can be the unintended but avoidable net effect. Second, retail managers are confronted with numerous, unproven ways to maximize shelf life. For example, many condone "washing" inventory before displaying it as a way to chill products, eliminate off-odors and reduce surface bacterial loads. However, it was pointed out in the previous chapter that substituting a passive step — like chilling previously displayed merchandise by returning it to the walk-in cooler for overnight storage — is more effective, more efficient and less prone to error than attempting to chill it by washing or dipping. Third, in most operations, there are substantial differences in the food handling knowledge and experience of employees; still all employees are responsible for activities that can inadvertently consume shelf life or compromise the safety of ready-to-eat foods. It is important to remember that all four elements of the preventive strategy *must be continuously achieved during retail stewardship if quality and safety are to be ensured.*

Although numerous opportunities exist to make instantaneous, permanent quality and safety errors; the display function—when properly organized—can simultaneously meet both merchandising and quality/safety objectives. Therefore, the objective of this chapter is to develop Standard Operating Procedures (SOPs) for the display function that:

- meet the first three elements in the preventive strategy outlined on page 41 (the fourth element, cleaning and sanitizing, cuts across all retail functions and is discussed in a separate chapter);
- offer an orderly, eye-appealing display that is easy to work from during the day;
- enable the evening employee to remove previously displayed but unsold merchandise from the display case(s) in a time-efficient manner while preventing contact among microbiologically dissimilar products or between products and insanitary food contact surfaces.

This chapter is comprised of two primary sections. The first section reviews the quality and safety errors encountered during the Standardized Quality and Safety Audits. Because the display function includes both **handling activities** and **passive holding** steps, the discussion of errors is further delineated into two secondary segments. The first segment addresses quality and safety errors that occur during **handling activities** required to set up, restock, and close down. For each activity, errors are addressed under appropriate elements of the preventive strategy including (a) any accidental contact venues among microbiologically dissimilar items or between products and insanitary food contact surfaces, and (b) violating first in-first out rotation sequences. For **passive holding** steps during display, case airspace and product temperature histories are reviewed. The second primary section of this chapter builds SOPs that eliminate each of the quality and safety errors highlighted in the first section. This section is also subdivided into two segments that reflect the two primary types of inventory carried in virtually all full-service seafood programs. The first segment addresses bulk-packed products such as fillets, steaks, shell-on headless shrimp, etc., that are customarily handled **individually** at some point in the retail inventory cycle and merchandised in service cases, while the second segment deals with prepackaged items such as shucked molluscan shellfish or tubs of picked crabmeat that are typically merchandised in self-service, ice-only equipment. Although both bulk-packed and prepackaged inventory share common concerns such as ensuring low product temperatures and respecting stock rotation sequences, there are some differences — notably inadvertent contact among microbiologically dissimilar **bulk-packed** items and the lack of sensory attributes in **prepackaged** inventory — that warrant distinct SOPs for each class of inventory.

Quality and Safety Errors Observed During Handling Activities

Three primary handling steps support the display function: (a) set up which includes staging, prepping activities, processing, and loading the case, (b) customer service, and (c) closedown procedures. Staging, preparation, processing, and case loading is performed by the department manager since that individual generally readies the department for business early in the morning. Customer service is generally performed by both shifts, though the greater volume of customer service is typically skewed toward the parttime staff member who works the afternoon/evening shift. This person is also responsible for closing down the department.

Staging Inventory for Stocking, Prepping This Inventory and Loading It in the Display Case

Staging

Staging is a necessary procedure and refers to the sequence of steps an employee uses to assemble inventory for display. Staging activities are partially dependent upon the closedown routine employed the previous evening. In the vast majority of departments audited, unpackaged items on display were typically removed from the refrigerated service case at day's end, and placed on a rolling, multi-shelved cart that was then wheeled into refrigerated storage until needed the next morning. This approach can be rapidly accomplished at the end of business, and enables the person opening the department the next morning to distinguish previously displayed inventory from that held in storage since receipt. Yet upon closer scrutiny of actual procedures, two quality/safety errors were typically made during staging.

Audits revealed that every aspect of the preventive strategy was compromised as employees set the display cases. In some stores short duration temperature spikes occurred when multi-shelved, rolling carts were removed from overnight storage. Product temperatures on these carts increased by 10°F.

Time/Temperature Abuse: Unless products are restocked rapidly in the display case, time/temperature abuse in the form of a short-duration spike can occur between removal from storage and stocking in the refrigerated service case. In some stores, auditors reported that several hours elapsed between the time that the multi-shelved rolling cart was removed from storage and cart contents were stocked in the refrigerated service case. Such an interval allowed the temperature of previously displayed inventory to increase by 10° F. Recall in Chapter 3 that when products were removed from optimal storage temperatures and held at ambient room conditions for four hours, trained evaluators judged the items spoiled one day sooner than identical products never exposed to a short-duration spike in temperature.

Accidentally Transferring Spoilage Bacteria Among SKUs Through Handling: Staging is the first opportunity that a variety of seafood products, all with different amounts of remaining shelf life, have to be handled by an employee. As outlined in Chapter 3, within a given delivery, the contents of each container have a remaining shelf life different from that of other containers. Such shelf life differences result from different levels of spoilage bacteria on product surfaces. Furthermore, shelf life differences can be created among the contents of a single container (page 25-26). These inherent or created differences in the abundance of spoilage bacteria need to be respected to prevent the bacterial load from an older product being accidentally transferred to a new item that sets the stage for accelerated spoilage of the newer item. Yet in most departments, auditors observed the morning employee handling all inventory without changing gloves or washing hands before handling the contents of different containers.

Just as easily, the practice of handling the contents of different containers without a glove change or hand wash could compromise the safety of bulk-packed, ready-to-eat products also displayed in the service case. An example of this would be stocking raw shrimp, then handling cooked, peeled shrimp without changing gloves or washing hands.

"Washing" or "Rinsing" Inventory Prior to Stocking

Most departments performed some type of washing, rinsing, or dipping activity before stocking inventory in the display case. This procedure was anything but standardized across the stores surveyed. The most commonly observed approach was to dip inventory to be displayed in standing water. In departments where dipping was practiced, auditors observed employees passing each saleable item through an ice water bath *without* first cleaning and sanitizing the sink compartment or lug that held the slush ice. Also, the entire mix to be displayed was dipped in the same ice water bath with no provision made to dip newer items first. Employees in some departments dipped only selected items, while personnel in other departments were observed dipping the entire inventory (10 to 20 different items) in the same slush-ice bath. At the other end of the spectrum, auditors observed individuals engaged in the more time-consuming, painstaking approach of picking up each fillet or steak, pouring slush ice over it, returning the item to a tote in the rolling, multi shelved cart, and then stocking the case after all items had been treated.

When SKUs were washed under tap water, product temperatures increased by 8°F.

When asked why the washing step was implemented, employees indicated that passing the items through a slush ice bath removed heat from the inventory prior to placing it in the display case. There is no question

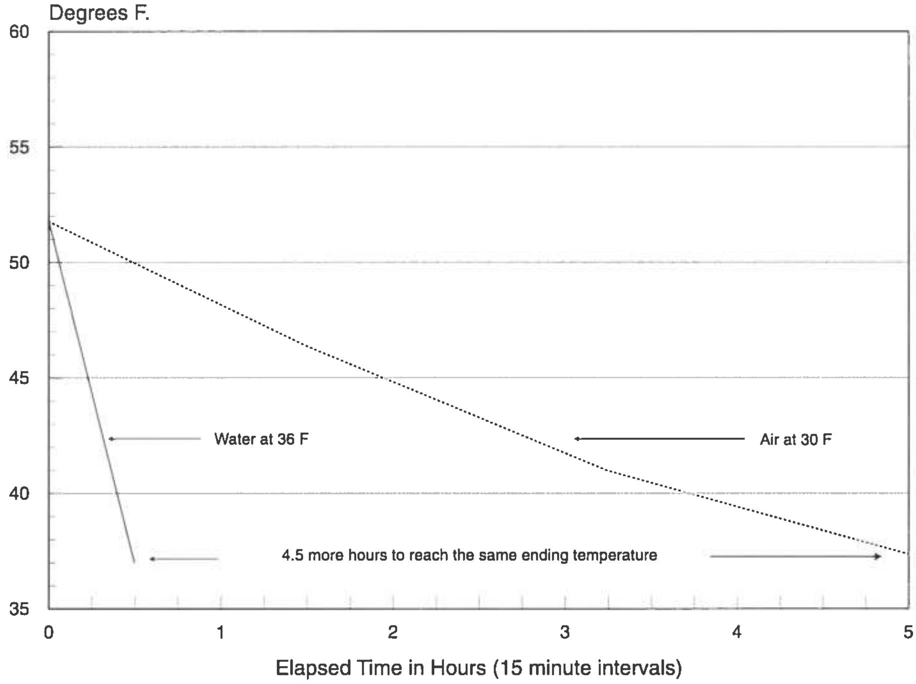


Fig. 5-1. The efficiency of removing heat from whole fish with cold water and slowly circulating cold air.

Melting ice is a much more efficient cooling medium than air.

that ice—in immediate contact with product—rapidly removes heat. Figure 5-1 illustrates that cold water can reduce the temperature of whole Atlantic cod by 15°F within 30 minutes whereas cold, circulating air requires five hours (300 minutes) to remove the same amount of heat.[1]

However, the question becomes whether such heat removal is necessary at retail. Across all cooperating departments, auditors found that the average temperature of products held overnight in refrigerated storage *already* approached optimal holding temperatures. Specifically, these products averaged 33.3°F when checked between 6 a.m. and 7 a.m., with temperatures ranging from 29.8°F to 39.2°F. Figure 5-2 (page 60) shows the distribution of product temperatures when held in refrigerated storage. The entire range of product temperatures is quite acceptable, with roughly 60 percent of the readings ranging between 29.8°F and 33.6°F. Even the warmest recorded temperature—39.2°F—was below the maximum refrigerated storage temperature set by public health authorities. Therefore, washing or spraying products to remove heat is an *unnecessary step* in the majority of stores.

In fact, an *improper* washing technique can actually *increase* product temperatures. In one department, employees used a single sink of slush ice; but when all ice had melted, fillets were rinsed under running water. Ironically, items in storage at this location were among the coldest the audits revealed over the entire project. However, with the additive effects of a 1.5-hour exposure to ambient store temperatures and a rinse under 75°F tap water, on average these products gained approximately 8°F (Figure 5-3, page 60).

Aside from heat removal, there is a prevalent thought within the gro-

Results of product storage temperatures collected in stores participating in the audits. Notice that 60 percent of the products checked were quite cold — at or below 33.6°F.

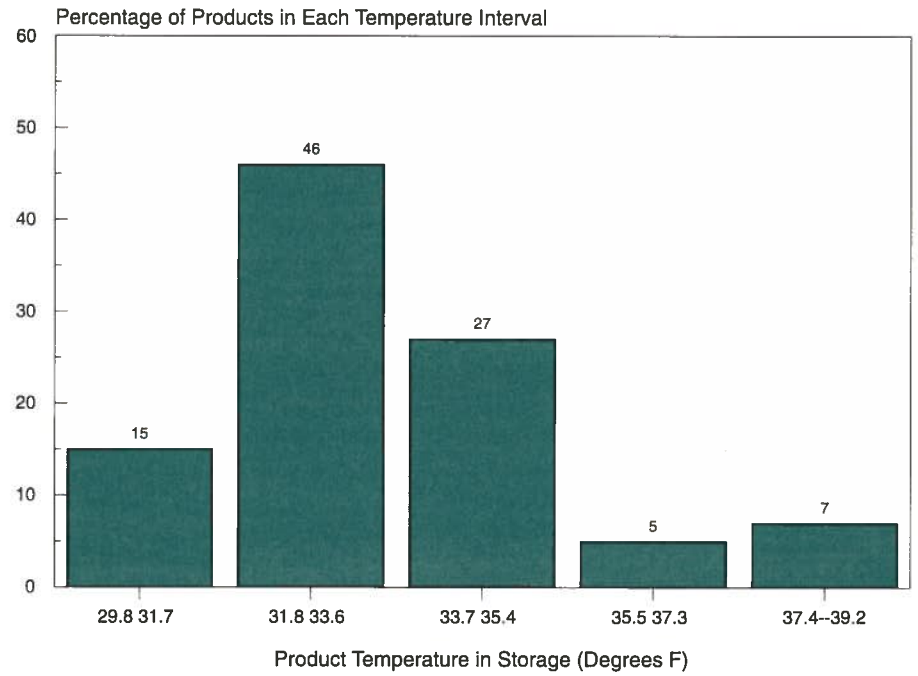


Fig. 5-2. Distribution of product temperatures when held overnight in refrigerated storage.

In one store employees rinsed some merchandise with tap water before it was placed on display. Even though products were stored under ice overnight in the walk-in cooler, this rinse with tap water increased product temperature by 8°F.

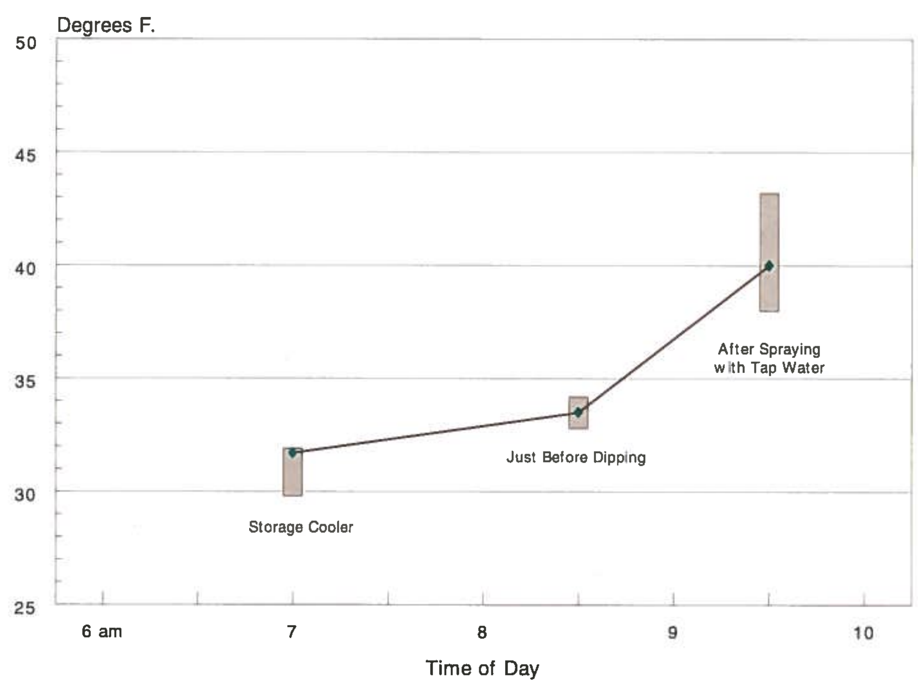


Fig. 5-3. Minimum, maximum and average product temperature changes from exposure to ambient store conditions and rinsing under tap water.

cery industry that passing items through an ice water bath, or giving each product a one to two second spray, effectively removes spoilage bacteria thus extending product shelf life. *Controlled experimentation does not support this contention.* Even when conducted under optimal handling regimens, the use of a shower spray at 30 psi—clearly the preferred approach over dipping in standing water—resulted in only slight reductions in spoilage flora that returned to pretreatment levels within several hours.[2] In addition to this analytical enumeration of differences in the abundance of spoilage bacteria with and without washing, the study also documented that no differences between washed and unwashed items based on the sensory parameters of eye appeal or odor. Other studies evaluating the effectiveness of washing products reported similar results. In a broad-scale effort to find ways of maximizing retail shelf life, researchers at Virginia Polytechnic Institute and State University reported that "dipping or use of commercial washing equipment produced no microbial or shelf life benefits."[3] *The important conclusion to be drawn here is that even under optimal handling procedures, the "wash" step was ineffective in extending shelf life or improving the sensory quality of skinless fillets or steaks.*

There are several unintended, negative consequences of washing. In those departments where the contents of different containers were passed through the same water bath, the very procedure used with the expectation of lengthening shelf life and improving sensory attributes only transferred bacterial loads from older products onto the surfaces of items having more remaining shelf life. Auditors saw no dipping procedures that considered remaining shelf life in sequencing products for washing. In instances where the sink compartment or lug was not cleaned and sanitized prior to product washing, additional transfer of bacterial loads surely occurred. Furthermore, all products were subjected to additional physical damage from (a) the repetitive handling required to move items into and out of the sink and (b) the physical agitation in the water baths.

Another unavoidable consequence of any washing step is the excessive time required for completion. Figure 5-4 documents the series of steps required to perform either the dipping procedure or the spray procedure. As this Figure demonstrates, to perform the procedure properly — that is to respect the shelf life differences among container contents and thus minimize inadvertent contact among microbiologically dissimilar items or between products and insanitary food contact surfaces — numerous steps are required, regardless of the option selected. Assuming that an employee has 10 SKUs to display and there are 10 items for each SKU, he must complete 230 repetitive steps with the shower spray option, or 160 repetitive steps with the dipping method.

Washing, by any method, offers no benefits (heat removal) that are not obtained through passive means. Such an approach inevitably consumes shelf life and cannot be recommended. Eliminating it would reduce the time required to ready the department, thereby allowing additional time for an employee to perform other essential duties.

Washing fish prior to display offers no temperature or microbiological benefit. Notice the time involved in correctly performing a procedure that is incapable of giving any benefit to the product. The message is simple — a procedure that offers no benefit and also has a downside risk (in this case systematic contamination of microbiologically dissimilar items) should be discontinued.

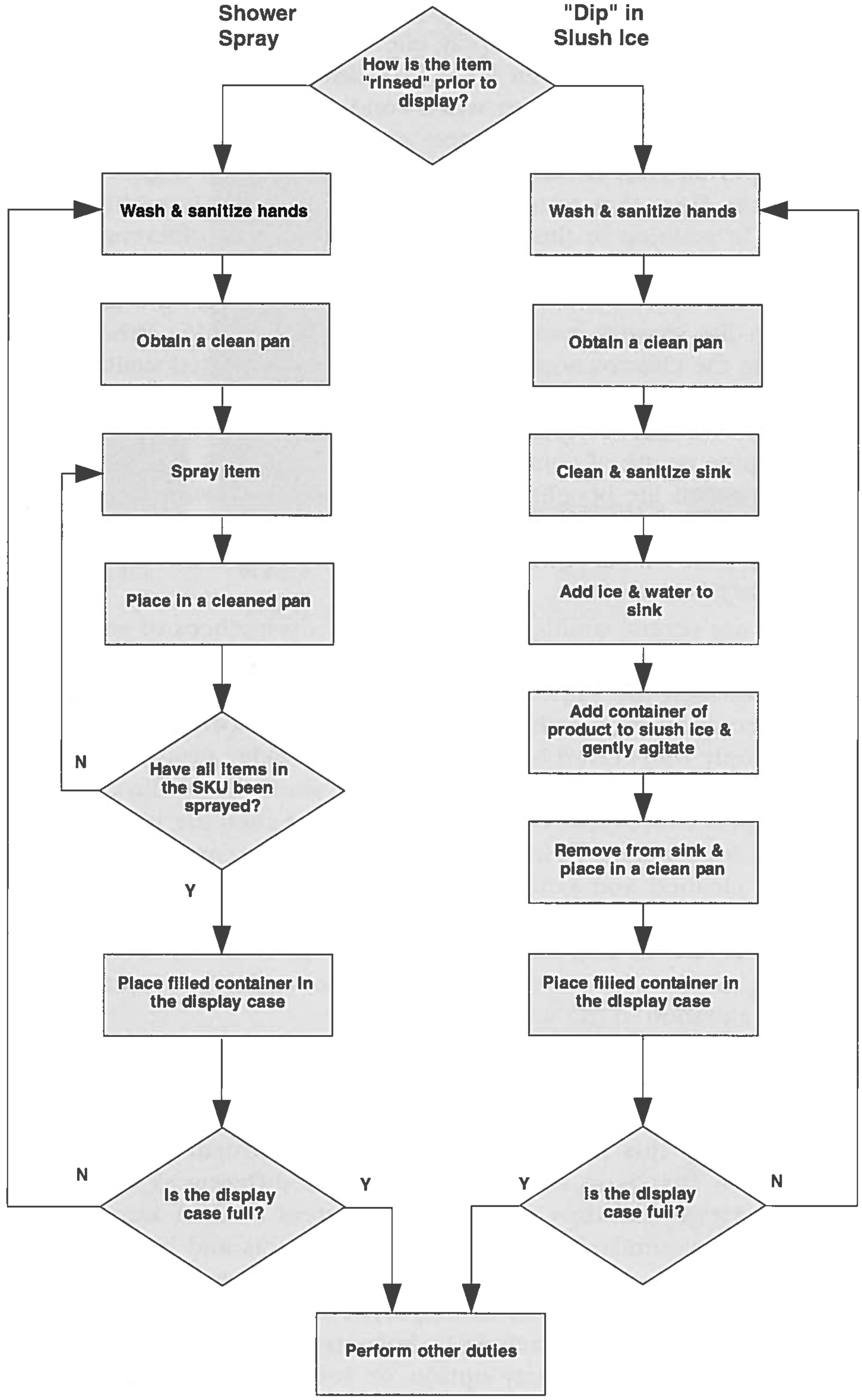


Fig. 5-4. Stepwise procedure set for dipping or spraying seafoods while complying with elements of the preventive strategy.

Loading The Case

Inadvertent Contact. One quality/safety error in loading has already been mentioned — the transfer of spoilage bacteria from one product to another through handling — either because gloves were not changed or hands were not washed before handling the contents of a different container. In operations that use various types of pans or bowls in the display case, the containers themselves may be primary sources of contamination because containers are used repetitively for different SKUs; yet, they are infrequently cleaned and sanitized. While auditors indicated that tap water was swished around in some pans before reuse, they never observed detergent cleaning and sanitizing of containers prior to being used with a different SKU. Perhaps the primary reason for this oversight is because departments are not issued duplicate sets of containers, so the available pans are in constant use.

Contaminating one SKU with dissimilar items frequently occurred, either through dipping products in standing water or handling subsequent SKUs without a hand wash or glove change during stocking or unloading.

Violating First In—First Out (FIFO) Rotation Sequences. On most days, displays of a single SKU were generally comprised of merchandise with different amounts of remaining shelf life. For example, a display of salmon fillets could be created with fillets removed from storage containers with different delivery dates, items from the same container that may have been treated differently through time (i.e., previously displayed merchandise or items never displayed), or various combinations thereof. As reviewed in Chapter 3, there can be significant shelf life differences in contents from the same package if some items were put on display while the remainder stayed in storage. *To maintain a FIFO rotation sequence within each SKU, employees need to load each item comprising an SKU in the case so that the topmost layer is the item with the least amount of remaining shelf life. Thus to sell on a FIFO system, previously displayed merchandise that originated from a container having the earliest delivery date needs to be stocked last (i.e., on top).* During the audits, previously displayed merchandise was restocked in the display case prior to the addition of newer products thereby violating rotational sequences. This occurred, in part, because employees did not have an immediate indication of how much "new" product was necessary to obtain the desired (or mandated) appearance until the previously displayed merchandise was stocked in the case. To complete the required look, "new" products (product removed from storage for the first time since receipt) were stocked on top of previously displayed but unsold items. Unfortunately, once the previously displayed merchandise was restocked, it was too late to stock the "new" merchandise *underneath* products with less remaining shelf life.

In those departments using pans, stock rotation sequences were often last in — first out. This practice occurred because previously displayed merchandise was replaced in the pan before new merchandise was added.

Customer Service Routine

During each audit, every employee always used some type of hand protection when selecting products for customers. In those instances when customers requested more than one item, employees changed gloves between selections. *This routine met the textbook definition of a standard operating procedure.* Of all the activities observed during the audits of retail department operations, this routine was the most consistent across all cooperating stores and employee skill levels. As such, it offers compelling evidence that Standard Operating Procedures can be instituted with a high degree of compliance among unsupervised staff members.

Closing Procedures

While morning setup operations are generally completed within one or two hours, the time allotted to close the department is relatively short. Normally, the afternoon/evening employee is expected to meet customer needs right up to the end of business, leaving little time to complete closing activities. Often, the time available to complete this procedure is compressed further because many firms require hourly employees to be "off the clock" by a certain time each day.

Although fewer activities are required to close the department than to ready it in the morning, there are two important points to keep in mind. First, closing is generally completed by less experienced staff members. Second, because management expects employees to be "off the clock" by a certain time each day, there are significant opportunities to violate provisions of the preventive strategy if (a) the close down procedure is improperly designed or (b) if a properly designed approach is incorrectly implemented. Therefore, simultaneously meeting time management objectives *and* ensuring that all elements of the preventive strategy are respected during closedown requires a litany of what to do and precisely how to perform each element in the procedure. Yet, no auditor reported seeing SOPs to guide an employee through the closedown activity.

Audits revealed that two elements of the preventive strategy were consistently violated during closing. First, emplyees consistently failed to remove items displayed in self-service, ice-only gondolas and return them to refrigerated storage for the evening. This oversight subjected ready-to-eat products like crabmeat, shucked oysters and surimi-based seafood salads to temperatures approaching ambient room conditions as the evening progressed and the ice melted away from the container sides. Importantly, this time/temperature abuse was also prolonged, continuing until the next morning. Second, the audits also documented that an employee would remove the entire case contents — generally various market forms of numerous finfish species along with different forms of shrimp (shell-on, headless, peeled, etc.) — by handling each item in succession without a glove change or hand wash. The net effect of this closing procedure is inadvertent contact among microbiologicaly dissimilar items that sets the stage for accelerated spoilage. In one store, an employee dropped displayed but unsold inventory (mostly skinless fillets) into plastic, carry-out bags, tightly rolled the bags, then placed them in the storage cooler. The rough handling observed in this procedure resulted in physical damage to skinless fillets. In addition to transferring bacterial loads from older to new raw products as they were removed and physically damaging fillets through rough handling, failure to wash and sanitize hands before ready-to-eat items were removed also resulted in some cross-contamination between raw and ready-to-eat items, suggesting heightened opportunities to compromise the safety of cooked shrimp, egg rolls, etc.

The Effect of Elapsed Time and Elevated Product Temperatures During Product Display

The time that elapses while a product is above optimal holding temperature is referred to as time/temperature abuse. There are two primary effects of time/temperature abuse: outgrowth of pathogenic bacteria such as *Staphylococcus aureus*, salmonella, vibrio, etc., which cause food-borne illness, and outgrowth of spoilage bacteria that consume shelf life. *Importantly, however, the vast majority of time/temperature abuse within the display function reduces product shelf life as opposed to threatening the safety of ready-to-eat items.*

Both elapsed time and temperature determines the effect on either product safety or shelf life. For example, within the public health arena, FDA and state regulatory authorities have established maximum time limits for holding picked blue crab meat at temperatures above 40°F. The rationale for this mandate stems from the characteristics of the pathogen *Staphylococcus aureus. S. aureus* causes food-borne illness through intoxication. To produce the amount of enterotoxin necessary to cause food-borne illness, large numbers of the pathogen — usually more than one million per gram — must be present or must have been present on the product at one time.[4] Thus, threshold levels of *S. aureus* are necessary on food to produce enough enterotoxin to cause symptoms. Because this pathogen grows rapidly between 44°F and 114°F, limiting the time product can be held at these abusive temepratures prevents outgrowth, thereby preventing toxin production.

With respect to shelf life (i.e., spoilage) issues, Chapter 3 demonstrated that the time required for bacterial populations to double is primarily influenced by temperature. The warmer the product, the more rapidly shelf life is consumed per unit of elapsed time (Figure 3-4, page 23). With a fixed amount of shelf life, product temperature determines whether the hours that remain to sell the product are consumed singly through the passage of time, or whether multiple shelf life hours are consumed with each passing hour. For instance, if products arrive with 88 shelf life hours remaining and these products are held at 32°F, the retailer has roughly 3.5 days (88 hours) to sell that product. Conversely, if the same product is held at 40°F during retail stewardship, the 88 hours of shelf life will be consumed in about two days (44 hours).

Time/temperature abuse can take many forms. Figure 5-5 illustrates the three primary combinations of elapsed time and heightened product temperature that can compromise the safety of ready-to-eat foods or consume the shelf life among raw products. As Figure 5-5 shows, short-duration spikes are relatively short time periods where a substantial difference ex-

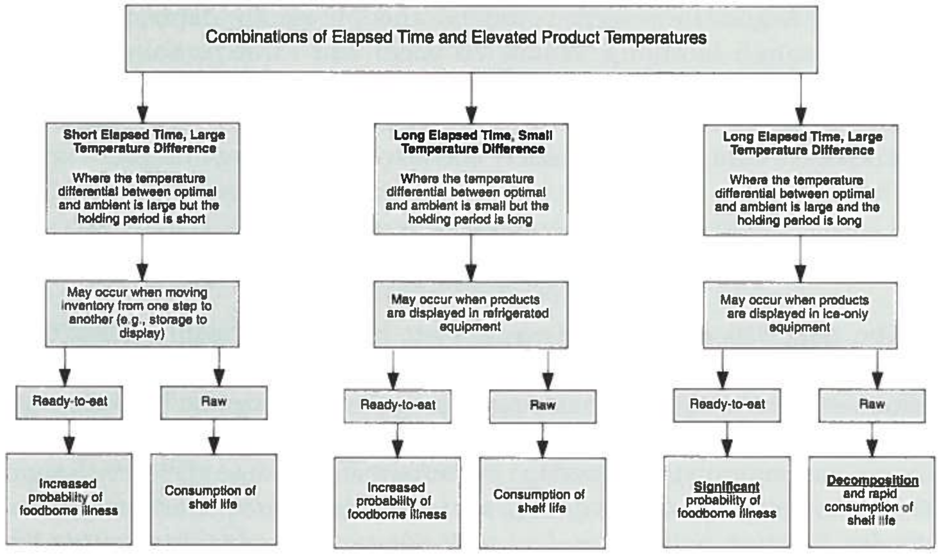


Fig. 5-5. Primary combinations of elapsed time and temperature differences that can create unsafe ready-to-eat foods or rapidly consume shelf life among raw products.

ists between optimal product temperature and ambient conditions. Perhaps the best example of a short-duration spike is when an employee maneuvers a multi-shelved, rolling cart out of refrigerated storage (where product temperatures hover around 32°F) onto the floor (where ambient store temperatures are in the mid-seventies) and allows several hours to elapse before product is stocked in a refrigerated display case. While the elapsed time is fairly short, the temperature differential between product and ambient store conditions is great thereby allowing the product to gain heat. A short duration exposure to ambient room temperatures in an otherwise unbroken period of *optimal* temperature control can reduce shelf life by one day.

At the other end of the spectrum, a large difference between optimal and ambient temperatures combined with a long holding period *rapidly* consumes product shelf life and *sharply increases* the possibility of foodborne illness with ready-to-eat foods. Practically every department has the capability for holding refrigerated inventory at elevated temperatures for long periods when displays in *ice-only* equipment are not properly managed.

The other combination of elapsed time and temperature differential is the most common situation with refrigerated display equipment: a lengthy holding period combined with a small differential between optimal holding temperatures (32°F) and ambient case airspace temperatures. While this form of time/temperature abuse is less obvious, it can result in disproportionate levels of accelerated spoilage.

Holding products even a few degrees above optimal temperature can result in disproportionate reductions in shelf life because of three important, interrelated reasons. First, many popular items arrive with much of their shelf life already gone given the normal course of harvesting, stowage aboard the fishing vessel, shoreside processing and distribution. As

Table 5-1. The Combined Effects of Elapsed Time and Product Temperature on the Amount of Shelf Life Consumed During Production, Processing, and Distribution

Function	Elapsed Hours	Product Temperature	Hourly Rate of Spoilage	Shelf Life Hours Used
Harvesting: On Board Storage	134	34	1.2	160.8
Processing & Distribution: Off-load vessel & truck to processor	3	36	1.4	4.2
Processor re-ices for the next morning's work	11	33	1.1	12.1
Fish are processed and packaged	8	41	2.2	17.6
Fillets stored in cooler	24	34	1.2	28.8
Fillets trucked to Airport	2	36	1.4	2.8
Air cargo accepts delivery - plane departs	4	38	1.7	6.8
Distributor receives shipment – transports product to warehouse	2	40	2.0	4.0
Distributor re-ices product, begins delivery and drop ships to retailer	8	35	1.3	10.4
Total Hours Elapsed	196			
Total Hours of Shelf Life Consumed				247.5

Time/temperature abuse obviously shortens the time available to sell perishable products. Any sort of time/temperature abuse can have dramatic effects on seafood shrinkage because most shelf life (70 to 80 percent) has been consumed prior to retail receipt. In addition, items that do not sell by the close of business must generally be held for an additional 18 to 21 hours before the next peak sales window.

Table 5-1 illustrates, by the time some products enter retail settings, 247 shelf life hours have already been consumed — approximately 74 percent of total shelf life. Second, though the temperature differential may be small, the long holding period dramatically influences the amount of shelf life lost during display. For instance, assume that stocking procedure A can return an average product temperature of 35°F while stocking procedure B can maintain product at a 40° F average temperature. At the end of a 12-hour display interval, 15.6 shelf life hours have been lost when stocking procedure A was used, but 24 shelf life hours were lost using procedure B. Thus, in the same 12-hour interval, stocking procedure B consumed an additional 8.4 shelf life hours. Third, items that do not sell by the end of business must generally be held for 18 to 21 hours before they are sold the following day (e.g., the elapsed time between 9 p.m. close down and the peak sales period the following day that begins around 4 p.m.). Depending upon the shelf life remaining at the end of the first day on display and the temperature during overnight storage and next day display, shelf life may be consumed prior to the peak sales period on the following day. Thus, any sustained temperature differences between optimal and

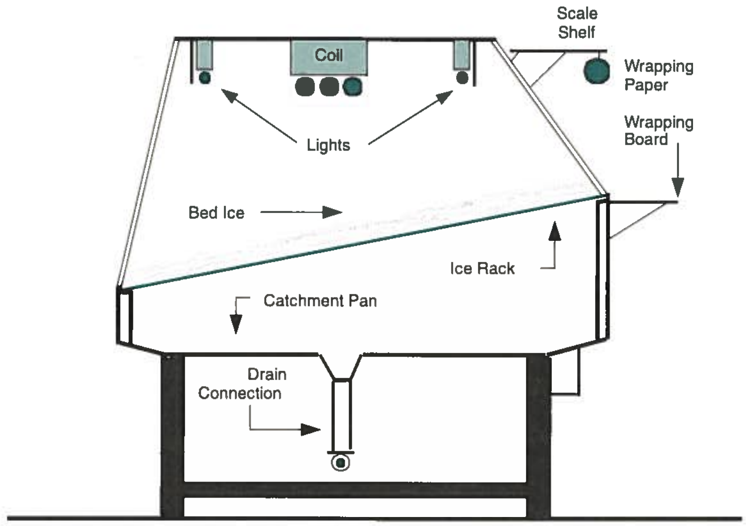


Fig. 5-6. Cross section of a refrigerated service case.

ambient conditions can chisel away at profitability though product temperatures are well within acceptable limits established by public health authorities.

Given that many products arrive with much of their shelf life already consumed, and unsold merchandise must be held for at least 18 hours before it sells the second day, it is important to evaluate the effects of elapsed time and temperature differences on remaining shelf life. To make such a comparison, a realistic level of remaining shelf life should be assumed for incoming refrigerated inventory. Using the results of Table 5-1, and comparing that against 336 hours—the total shelf life available for a product such as Atlantic Cod when held under optimal conditions—it seems appropriate to assume that upon receipt remaining shelf life amounts to roughly 88 hours.[5] Of those 88 hours, the consumer must be provided with some time to purchase, transport, hold, and prepare the item; say 10 shelf life hours. Under ideal conditions that would allow the consumer 10 elapsed hours, but with transport home in a warm vehicle and storage in a 42°F refrigerator, those 10 shelf life hours are consumed in fewer than 10 elapsed hours. Therefore, accounting for the time necessary for consumer use, the *net remaining shelf life* would be 78 hours, or 88 shelf-life hours remaining less 10 shelf life hours for consumer use.

Temperature Histories of Products Held in Refrigerated Service Cases

Many types of refrigerated service cases were in use throughout the cooperating departments. Auditors observed that in recently renovated departments, the refrigerated service cases were of a more modern design that provided access from the front (i.e., customer) side via a hinged glass panel. Older, more traditionally styled equipment maintained a fixed front glass that required all stocking to take place from the rear. Design differences aside, all cases used large quantities of crushed or flaked ice as a base for stocking products, and by definition all such cases controlled case airspace temperature (Figure 5-6).

Table 5-2. Average Product Temperatures Recorded During Display with Estimated Loss in Shelf Life Over Twelve Hours				
Store	Average Product Temperature	Shelf Life Lost Per Elapsed Hour	Product Residence Time	Shelf Life Hours Lost During Display
Chain 1 - Store 1	34.6 ± 0.6	1.3	12	15.6
Chain 1 - Store 2	33.4 ± 2.6	1.1	12	13.2
Chain 1 - Store 3	34.5 ± 0.9	1.2	12	14.4
Chain 1 - Store 4	35.8 ± 2.3	1.4	12	16.8
Chain 2 - Store 1	33.1 ± 2.3	1.1	12	13.2
Chain 2 - Store 2	34.4 ± 2.1	1.2	12	14.4
Chain 2 - Store 3	38.6 ± 3.9	1.8	12	21.6
Chain 3 - Store 1	33.5 ± 1.6	1.1	12	13.2
Chain 3 - Store 2	35.7 ± 2.2	1.4	12	16.8
Chain 3 - Store 3	NA	NA	NA	NA
Chain 4 - Store 1	35.2 ± 1.2	1.3	12	15.6

During the sales day, temperatures for the entire product mix on display were collected approximately every other hour. An average temperature for each product displayed in each cooperating department was then computed. These average temperatures were then compared against *Food Code* recommendations for holding potentially hazardous food (i.e., raw or heat-treated foods — of either plant or animal origin capable of supporting the rapid and progressive growth of infectious or toxigenic microorganisms). The 1997 *Food Code* specified two tiers of holding temperatures (41°F and 45°F) that correspond to two different maximum holding periods for ready-to-eat, potentially hazardous foods that are manufactured on-site. When these average product temperatures were compared against current temperature requirements, 100 percent of all products were below 45°F, suggesting that all retail seafood departments that participated in the audits maintained product temperatures during refrigerated display that were well within the guidelines established to ensure public health.

A consistent finding in the standardized quality and safety audits was maintenance of low product temperatures during display in refrigerated service cases.

Cooperating retail departments maximized the time available to sell refrigerated seafoods by maintaining low product temperatures. As indicated in Table 5-2, average product temperatures for the entire mix held in the refrigerated service case ranged from 33°F to 39°F. Using an assumed case residence time of 12 hours, retailers are losing as little as 13 hours of shelf life, and at most about 22 shelf life hours during this display interval.

A wide spectrum of stocking procedures was used by cooperating departments. By far the most common approach was to pile products on butcher paper laid on the bed ice. A few stores placed some of their displayed product line in pans that were either placed on ice or embedded in ice. In one store, crushed ice was placed in ceramic bowls, products

All other case airspace temperatures fell between these two extremes.

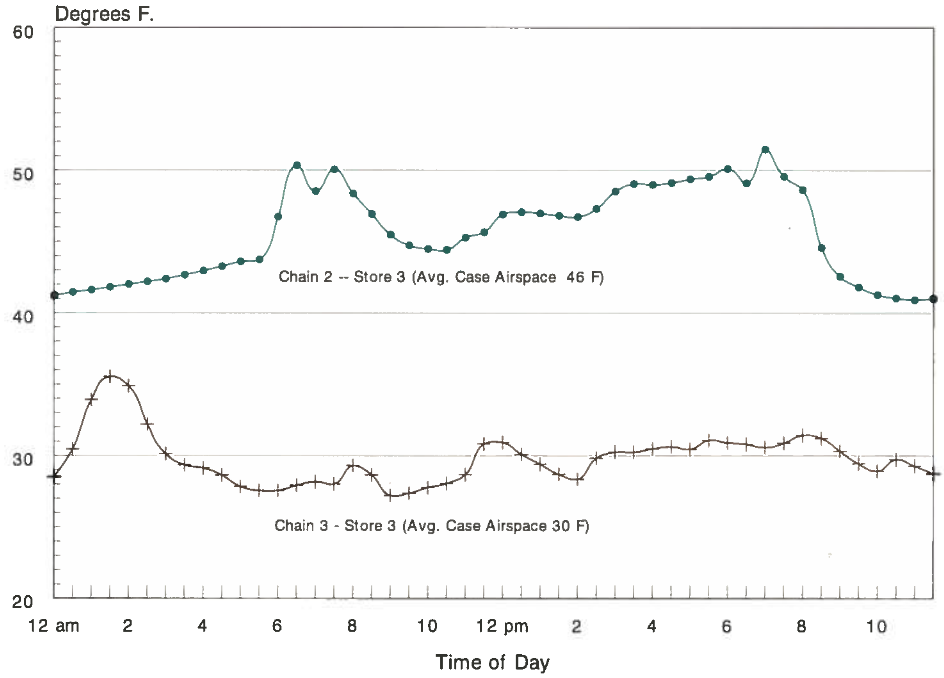


Fig. 5-7. Audit data: The range in case airspace temperatures among cooperating departments.

were added, and the filled container was nested in ice. The net effect of this stocking method was to soak the product in melted ice. Unfortunately, this coincided with the peak sales period (4 p.m. to 7 p.m.).

Although various stocking methods were employed throughout cooperating departments, product temperatures during display were, with one exception, consistently low. The primary reason is low case airspace temperature settings. Heat gain is proportional to the temperature differential between the product and the "environment" (i.e., the airspace of the refrigerated case). The colder the environment, the less heat transferred to the product. Figure 5-7 presents the range in case airspace temperatures collected during the audits. Temperature data collected over the three days were averaged by time period into a single 24-hour profile. Case airspace readings for all other departments fell somewhere between these two curves. Among all cooperating departments, the highest average case airspace temperature over a 24 hour cycle was 46°F while the lowest average case temperature was 30°F.

Temperature Histories for Products Held in Ice-only Cases

Two primary types of ice-only display cases are used by the grocery industry. Some firms have opted to install full service ice tables, and the entire product line is merchandised in this equipment. The other type of ice-only equipment is the freestanding, self-service gondola. This unit is used in virtually all stores that offer service seafood. Although each type of apparatus is essentially identical in design, an ice table is typically used to

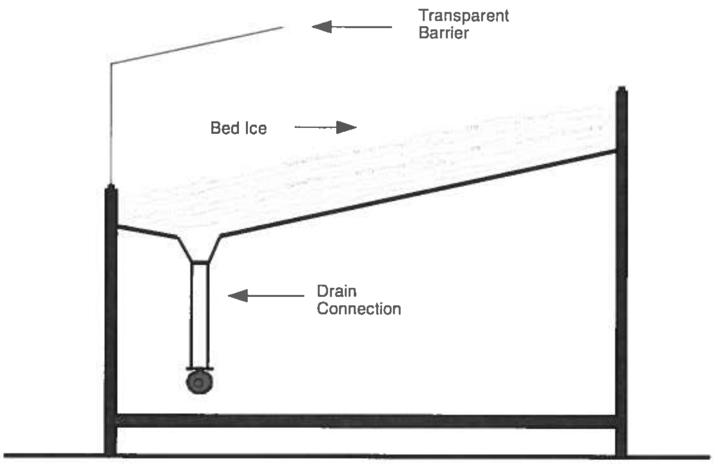
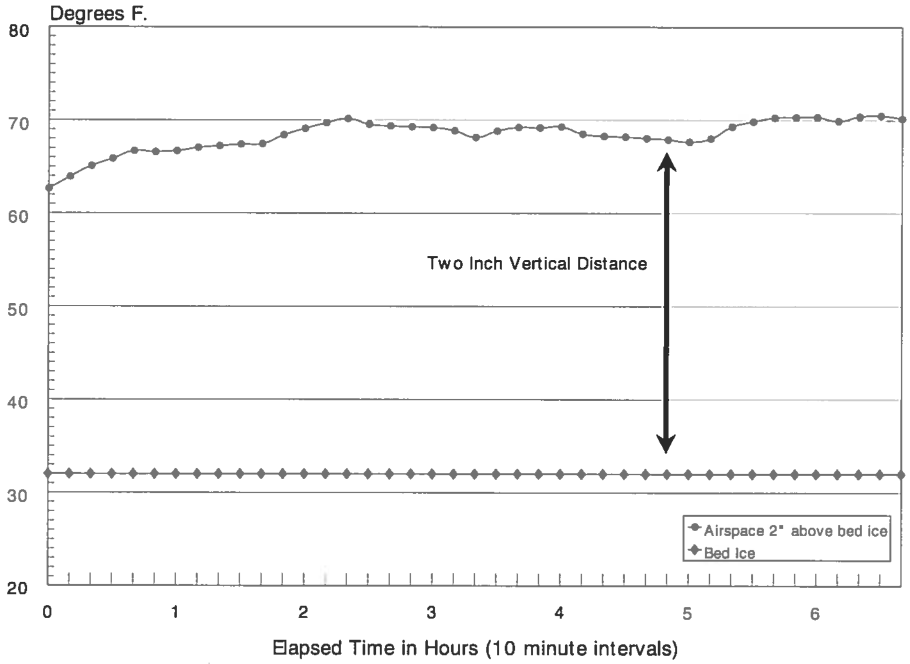


Fig. 5-8. Cross section of a full-service ice table.

display loose items such as fillets, steaks, shrimp, etc. in a service environment. Conversely, a freestanding gondola is used to display various containerized items that lend themselves to self service.

Full Service Ice Tables

Full service ice tables were the rare exception among cooperating stores, though in some regions of the country this type of equipment is quite popular (Figure 5-8). A primary attribute of ice tables is a relatively accessible, easily cleaned surface area. However, ice tables have a major drawback over refrigerated cases: lack of effective temperature control above bed ice. *As the vertical distance from bed ice increases by just two inches, the chilling effects of the ice are virtually eliminated. In fact, air*



Ice alone does not cool the airspace immediately above it. The result is a rapid loss in shelf life when products are displayed on the ice.

Fig. 5-9. Case airspace temperature two inches above bed ice in an ice table.

Table 5-3. Chronology of Retail Activities and Their Cumulative Effect on Time Available for Displaying Products in an Ice Table							
Day	Retail Activity	Beginning Shelf Life	Elapsed Hours	Avg. Product Temperature	Hourly Shelf Life Consumption Rate	Shelf Life Hours Used	Remaining Shelf Life
D-0 11 am	Product accepted and placed in cooler until 7 am the next day.	78.0	20.0	32.0	1.0	20.0	58.0
D-1 7 am	Manager removes item from storage and places it on display until 9 pm.	58.0	14.0	42.0	2.3	32.2	25.8
D-1 9 pm	Unsold merchandise is returned to storage cooler until 7 am.	25.8	10.0	32.0	1.0	10.0	15.8
D-2 7 am	Previously displayed item returned to display	15.8	6.9	42.0	2.3	15.8	0.0
D-2 2 pm	If not sold by 2 pm, item is discarded						

temperature measured two inches from bed ice approximates ambient room conditions (Figure 5-9).

In the cooperating department that used a full service ice table, several stocking methods were used depending upon the item. Some products, like unprocessed, locally harvested fish, were placed on ice while items such as scallops were held in shallow pans embedded in ice. Items such as shrimp were placed in shallow depressions in the ice. The temperature of all products averaged 42°F over the twelve-hour case residence time. The significance of hours of elapsed time combined with a 42°F average product temperature is best examined with an example. As Table 5-3 illustrates, products arrive with roughly 78 hours of net shelf life remaining (88 hours less 10 shelf life hours for consumer use). If these products are displayed on an ice table the retailer has roughly two days to sell the item before shelf life is consumed. As the last row in Table 5-3 shows, the previously displayed product must sell by 2 p.m. on the second day. Depending upon when daily sales occur though, there may not be enough shelf life remaining on Day 2 to coincide with the peak sales window. Such a situation could sharply increase avoidable shrink.

Ice tables cannot maintain optimally low product temperatures if products are stocked *on* ice. The inability to control product temperature coupled with typical case residence times of 12 to 14 hours, implies that product shelf life will be rapidly consumed. Yet, except for public health-related mandates, the display function is one arena where few per se' rules exist. Choice of display cases is one such example. Should a retailer opt for an ice table instead of a refrigerated service case? Regrettably, the correct answer is "it depends."

The decision to use an ice table as the primary merchandising appliance should be based on several interrelated conditions. For example, if inventory is readily available from direct, local sources an ice table may be an acceptable choice since products should arrive with far more shelf life remaining than the 20 to 25 percent typically available when products originate from other production areas and are subsequently distributed through traditional channels. Therefore, products that arrive with more of their shelf life remaining can sustain more rapid consumption of it if case residence time is short. If inventory turnover out of the ice case is rapid, say four hours, the effect of higher holding temperature is offset by a short holding period. Of course, a short case residence time suggests that sales are brisk, and carry-overs from the previous day are the exception rather than the rule. Furthermore, *the entire product mix* should turn over at about the same rate. Ice tables are appropriate for those departments that offer custom processing for virtually all products. In this situation, an ice table is an excellent choice because these relatively unprocessed items (i.e., whole or dressed fish, shell-on, headless shrimp, etc.) can be periodically top iced. So long as ice melts over product surfaces, optimal product temperatures are maintained, regardless of ambient conditions. The vast majority of retail seafood departments do not operate in a manner consistent with these criteria. For instance, a merchandising strategy predicated on buying whole fish and custom processing to order occurs in only a select few trading areas. With respect to sales velocity, a four-hour case residence time is the exception rather than the rule for most grocers. Thus, most retailers should *not* consider ice tables as their primary way to merchandise refrigerated inventory.

Self Service Free-standing Gondolas

Temperatures of products held in ice only equipment were typically far above optimal levels. When picked crabmeat, shucked oysters, and seafood salads are merchandised in ice only equipment, high holding temperatures may compromise product safety.

Merchandise held in self service freestanding gondolas exemplified another departure from ideal holding temperatures. In some instances auditors found product temperatures in the 50°F to 60°F range. Such elevated product temperatures combined with case residence times of 8 to 12 hours consumed large proportions of remaining shelf life each day. Besides rapid consumption of remaining shelf life, these high holding temperatures posed a real food safety threat since the products merchandised in these units were usually ready-to-eat foods. A high product temperature among these ready-to-eat items is itself a key issue, but two other conditions combine to create a major food safety trouble spot for food retailers. First, employees seldom use sensory cues such as odor to assess quality of containerized merchandise. Instead, they rely on the sell-by date to determine whether these items should be marked down for immediate sale or discarded. Yet, the sell-by date is predicated on optimally cold product temperatures. Second, auditors observed many ready-to-eat items with sell-by dates ten to fourteen days *beyond* the current date of observation. Audits revealed that a ready-to-eat product held at the 50°F to 60°F range for one or two days would at least be of marginal quality, and, at most, sharply boost the op-

Table 5-4. A Review of Quality and Safety Errors

Preventive Strategy Element Violated	Current Approach Revealed Through The Audits	Type of Error
Rotate Inventory on a First In — First Out Basis	Previously displayed merchandise generally stocked first, with the balance added last from new (never displayed) inventory.	Improper Technique
Minimize Contact among Microbiologically Dissimilar SKUs	Loading (unloading) the case by handling all SKUs without a hand wash or glove change between different batches.	Improper Technique
	Using previously used pans across different SKUs without first cleaning or sanitizing them.	Improper Technique
	Dipping all SKUs in the same sink compartment without a cleaning and sanitizing routine between different SKUs.	Needless Activity
	Rinsing all SKUs without a hand wash or glove change between batches.	Needless Activity
Maintain Cold Product Temperatures	Allowing several hours to elapse between rolling out the cart and stocking inventory in the display case.	Improper Technique
	Improper stocking procedures used for **ice tables and freestanding gondolas** that failed to control product temperature during case residence time.	Improper Technique
	Dipping or rinsing all SKUs to remove heat from inventory stored overnight under refrigeration.	Needless Activity
	Washing refrigerated products like fillets and steaks with tap water that allowed about an 8°F increase in product temperature.	Needless Activity
	Forgetting to remove prepackaged product displayed in ice-only equipment during close down procedures. Time/temperature abuse will occur as ice melts away from container surfaces throughout the evening.	Inadvertent Omission

portunities for food-borne illness. However, holding inventory at elevated temperatures for ten to fourteen days—the time remaining according to the sell-by date—places the retail firm in the cross hairs of a potentially serious, costly dilemma.

A Summary of Quality and Safety Errors Observed During the Display Function

Various quality and safety errors found in the display function during the audit process are summarized in Table 5-4. In reviewing the causes of these errors, one was the result of a needless activity—washing the product prior to stocking in the case. Stopping the wash step would simultaneously (a) reduce inadvertent transfer of bacterial loads among microbiologically dissimilar items or between products and insanitary food contact surfaces and (b) shorten the time required to ready the department in the morning. Another error was an omission. Auditors consistently noted that packaged items in self-service, ice-only merchandisers were not removed and returned to refrigerated storage overnight. Therefore, that task should be added to the closedown procedure set. All other errors resulted from improper techniques used to complete a necessary activity. To minimize the occurrence of these errors, new ways of completing these compulsory tasks are required.

Maintaining low product temperatures is a special compulsory task. Holding temperature is, in part, determined by how products are stocked in the case. Thus, temperature control is ensured by correctly performing the activity of loading the case. During the audits, the only consistent errors in product temperatures during display were observed with either the full service ice table or the freestanding self service gondolas. In refrigerated cases however, product temperatures were generally low. Nevertheless, managers need to realize that the different types of display equipment in a given chain can create a major source of variation in product temperature. For example, in Table 5-2 where average product temperatures during display were presented, two stores within the same chain had average product temperatures that were about 5°F different from one another. Although this difference is generally imperceptible to the touch, if the stocking procedure in the warmer case did not buffer the product from warmer case airspace temperatures then this higher average temperature would consume an additional 8.5 hours of valuable shelf life given the same number of hours on display. As explained in the preceding section, the net effect of inadvertently losing eight or nine shelf life hours may be having to discard the product a day earlier since unsold merchandise generally requires a holding period of 18 to 21 hours prior to sale the next day.

Developing Standard Operating Procedures to Address the Quality and Safety Issues Uncovered in the Audits

As stated in Chapter 4, performance improves only when both steps in the design process are successfully addressed. Recall that the first step is to specify steps and procedures that "are the right things to do." Expressed differently, this goal should ensure that all elements of the preventive strategy outlined on page 43 are met during the various activities required in the display function. With respect to the preventive strategy, there are four issues that the SOP should address. First, it should minimize the elapsed time between removing items from storage and stocking them in the display case(s). Second, the SOP should ensure that within each SKU, items displayed the previous day (or days) are positioned to sell prior to newer items (i.e., items within the same SKU held in storage since receipt). Third, the SOP should minimize contact among microbiologicaly dissimilar SKUs during all loading and unloading activities. Fourth, the SOP should ensure that products are maintained at constant low temperatures during display.

In addition to specifying procedures which "are the right things to do," designers need to ensure that "the right things are correctly done." Thus, the SOP must also address the concerns of managing multi-unit operations with scarce resources. In particular, all SOPs should be designed so that a high level of compliance can be achieved by a labor force that varies widely in food-handling knowledge and experience. This generally requires a streamlined, simplified approach that gears activities and tasks to expected skill levels. Additionally, the same SOP should meet the requirements of the preventive strategy across all full service departments within the chain. This requirement—in itself—supports both the simplification of duties and compliance evaluation by managers. Finally, the SOP should be designed so that feedback is available. This enables employees to learn the proper steps and the correct ways of implementing them.

To meet both design criteria, some steps may need to be dropped from the task set, others perhaps need to be added, and the way that some are performed may need to the changed. Such was the case within the display function.

Despite the wide product line typically available in full-service seafood departments, each element in the line can be categorized as either bulk-packed items handled without any protective packaging, or items prepackaged in consumer quantities. Generally speaking, the way that products are packaged upon arrival generally dictates how they will be displayed. Bulk-packed items are usually merchandised in a refrigerated service case. On the other hand, prepackaged products such as picked crabmeat and shucked molluscan shellfish lend themselves to a self-service venue that often relies on some type of ice-only display vessel such as a freestanding gondola.

Therefore, two SOPs are required, one for each product category. The remainder of this chapter outlines precise Standard Operating Procedures for each product category. These SOPs are the end results of objective performance testing. Importantly, each SOP is designed using assumptions about future departmental operations: (a) no increase in the number of full time equivalents necessary to staff the department, and (b) no reduction in turnover among the parttime staff.

A Standard Operating Procedure for Bulk-packed Inventory Using Pans

Table 5-5 summarizes (a) quality and safety errors made with bulk-packed inventory, (b) a proposed solution that simultaneously meets the product-oriented goals established by the preventive strategy, and (c) the managerial requirements that make the plan workable. A common theme runs throughout the proposed solution: the use of pans. In fact pans are the "heart and soul" of this SOP because the proper use of pans helps to accomplish each objective—from ensuring a FIFO rotation plan to reducing the frequency and time required to disassemble and clean a display case.

As noted in the audits, some departments currently use pans, bowls, or containers to display a portion of their inventory. For the proposed SOP, however, the use of pans is imperative. Many types of containers are available that are manufactured from a variety of materials: ceramic, glass, stainless steel, maleable plastic, rigid plastic (polycarbonate), etc. Despite a wide set of choices, steam table type pans best meet the needs of the full-service department.

Steam table pans are available in a variety of dimensions; ranging

Table 5-5. Solving Current Quality and Safety Errors within the Bulk Packed Product Line		
SOP Objective	**Current Approach Revealed through the Audits**	**Proposed Solution**
Ensure Proper Rotation of Inventory	Previously displayed merchandise generally stocked first, with the balance added from new (never displayed) inventory. Long vertical ribbons do not facilitate a FIFO rotational scheme because previously displayed merchandise is not distinguished from products having more shelf life.	Containerize each SKU in a pan. When loading pans, use a cleaned, sanitized pan, and load it first with new product, then "top off" with previously displayed product. This facilitates the sale of previously displayed merchandise first that day.
Minimize Elapsed Time Between Roll out and Stocking	Several hours elapsed between roll out and stocking in the refrigerated case.	Where possible, load pans in the cooler, using "never displayed" and previously displayed merchandise as required, then roll out and stock filled pans in the case. Where a reach-in cooler is used, load previously displayed products into cleaned pans, next add new merchandise, then place pan in display case.
Minimize Contact among Microbiologically Dissimilar SKUs	Loading (unloading) the case was typically accomplished by completing all like tasks the same time. Thus, all SKUs were loaded (unloaded) as one step, without a hand wash or glove change between different SKUs.	Except for customer service, only the most experienced staff at member handles individual bulk packed inventory items (i.e., individual fillets, steaks, etc.) during the morning loading procedure. Upon close down, the evening staff member does not handle individual items; rather, he places lids on pans, removes them from the service case, and returns previously displayed merchandise to the walk-in cooler. During the sales day, pans also provide a physical separation between dissimilar items.
Maintain Cold Product Temperatures	Generally cold hold temperatures during display were maintained. However, a common approach is needed across the firm that achieves low product temperatures regardless of case type.	When stocking, embed pan in bed ice up to the lip of the container.
Reduce the Frequency and Time Required to Clean and Sanitize the Case	Drip accumulates in the catchment pan of the display case (Figure 5-6) and creates an odor. To clean and sanitize the chatchment pan, a complete disassembly is required. Specifically, inventory must be removed, ice melted, and ice racks removed to gain access to the catchment pan. While periodic disassembly and cleaning is necessary with the current stocking approach of placing products on butcher paper, it is a time consuming activity typically completed by the least experienced individual.	Because all pans used are cleaned each day, odor control is easier, and more effective.

Across the bulk packed product line, steam table pans with lids and perforated inserts facilitate: (a) proper stock rotation sequences, (b) optimal temperature control, and (c) complete separation among dissimilar items.

from "full-sized" pans that are roughly 12 inches by 24 inches, to "quarter-sized"—about 6 inches square. The area (width and length) of steam table type pans should correspond to the size of individual items within an SKU and the expected sales volume in a given day. For example, a container for catfish fillets or salmon steaks could be 10 inches x 13 inches while a container for shell-on, headless shrimp could be 12 inches x 24 inches if sales volume warranted.

In addition to the pans themselves, each pan must have a lid (required for closedown and overnight storage) and a perforated insert that holds the product off the pan bottom by 1/4 of an inch. This insert is an important element in the SOP because it separates the product from any drip; yet, holds this liquid. Containing drip, instead of allowing it to collect in the catchment pan, sharply reduces the frequency of case disassembly for cleaning and sanitizing; yet, minimizes off odors originating from the department because display pans are cleaned and sanitized each day.

Having two pans for each SKU to be displayed enables employees to begin with a cleaned, sanitized pan. When two pans are used, employees can differentiate previously displayed but unsold merchandise from that held in storage since receipt. This distinction will enable employees to fill a cleaned, sanitized pan with new merchandise coming out of storage prior to "topping off" with previously displayed items.

Finally, the auditors highlighted that in some departments the pans themselves facilitated the transfer of bacterial loads between dissimilar products because the same pan was in constant use, often for different SKUs. This SOP, therefore, requires two pans and two inserts for every SKU—one set in use and another sanitized set available for later use. Although several pan depths are available, a pan at least at least six inches deep should be used because the lid and insert consume about 1 1/2-inch of vertical capacity (Figure 5-10). Conversely, a pan two inches deep equipped with a perforated insert and lid would have very little vertical capacity remaining for the product.

Two pans with lids and inserts are required for each SKU.

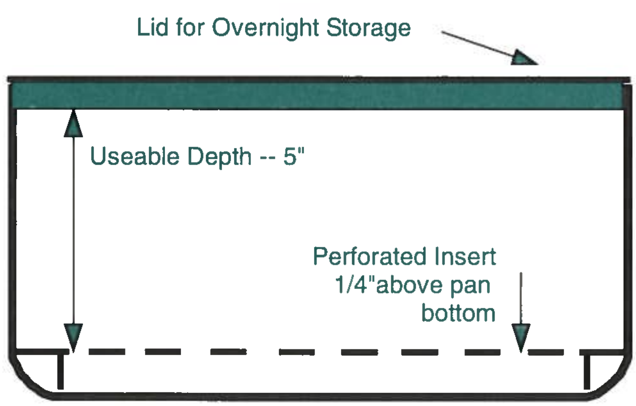
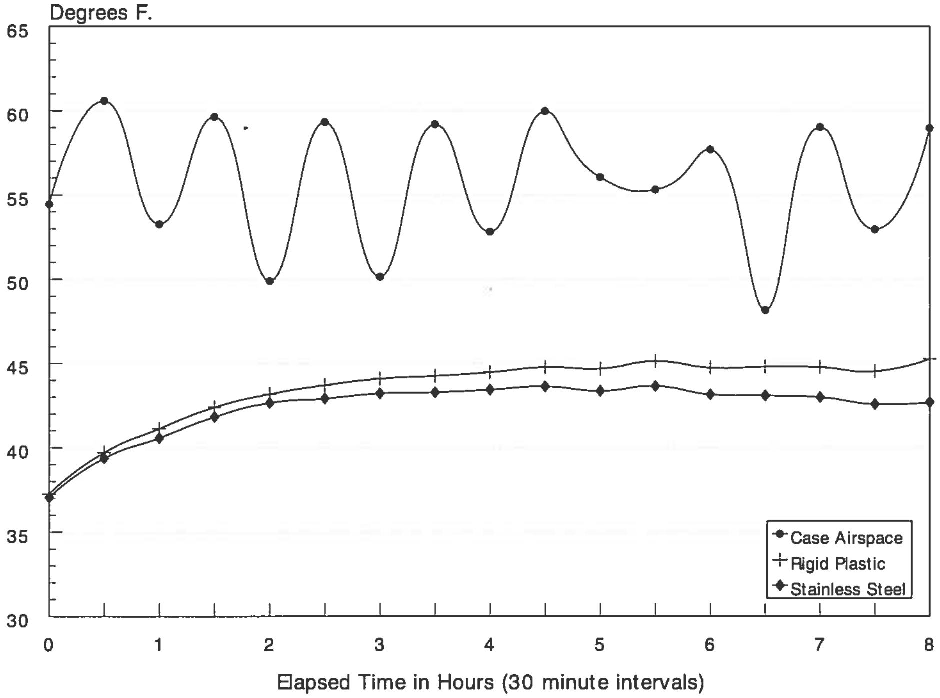


Fig. 5-10. Detail of plan used to meet preventive strategy goals and boost labor productivity.



There is no significant difference in product temperature when plastic and metal steam table pans were embedded in ice.

Fig. 5-11. The influence of container material on product temperature when pans are embedded in ice in a refrigerated case set to average at 50°F.

Steam table pans were originally manufactured out of stainless steel. With advances in plastics technology, steam table pans are available in both stainless steel and a high density, transparent plastic (polycarbonate). Both material types can be used for both holding hot and cold items. For some, the issue with pans at retail has been whether the plastic material does as good a job as the stainless steel in maintaining cold product temperatures. To test this idea, steam table-type pans manufactured of stainless steel and polycarbonate plastic were embedded in ice, and a stack of three fillets was added to each pan. Thermocouples were inserted at the approximate geometric center of each fillet, and product temperatures were recorded over eight hours. Figure 5-11 presents the results of this trial. As the figure illustrates, a *slightly higher* average temperature was recorded for products held in the plastic pan (43.5°F) compared with products held in the stainless steel pan (42.3°F).

Two important conclusions can be drawn from this trial. First, the difference in average product temperature—1.2°F—was minimal, which suggests that over the eight-hour trial virtually the same amount of shelf life would be lost with either material type. Also, it is worth noting that the 1.2°F average product tempeature difference would virtually disappear if this experiment was repeated with the colder airspace temperatures recorded during the audits (Figure 5-7, page 70). Second, so long as pans are embedded in ice, low product temperatures can be maintained regardless of container material differences. Thus the decision about whether to use metal or high density plastic should be based on meeting cosmetic objectives such as eye appeal.

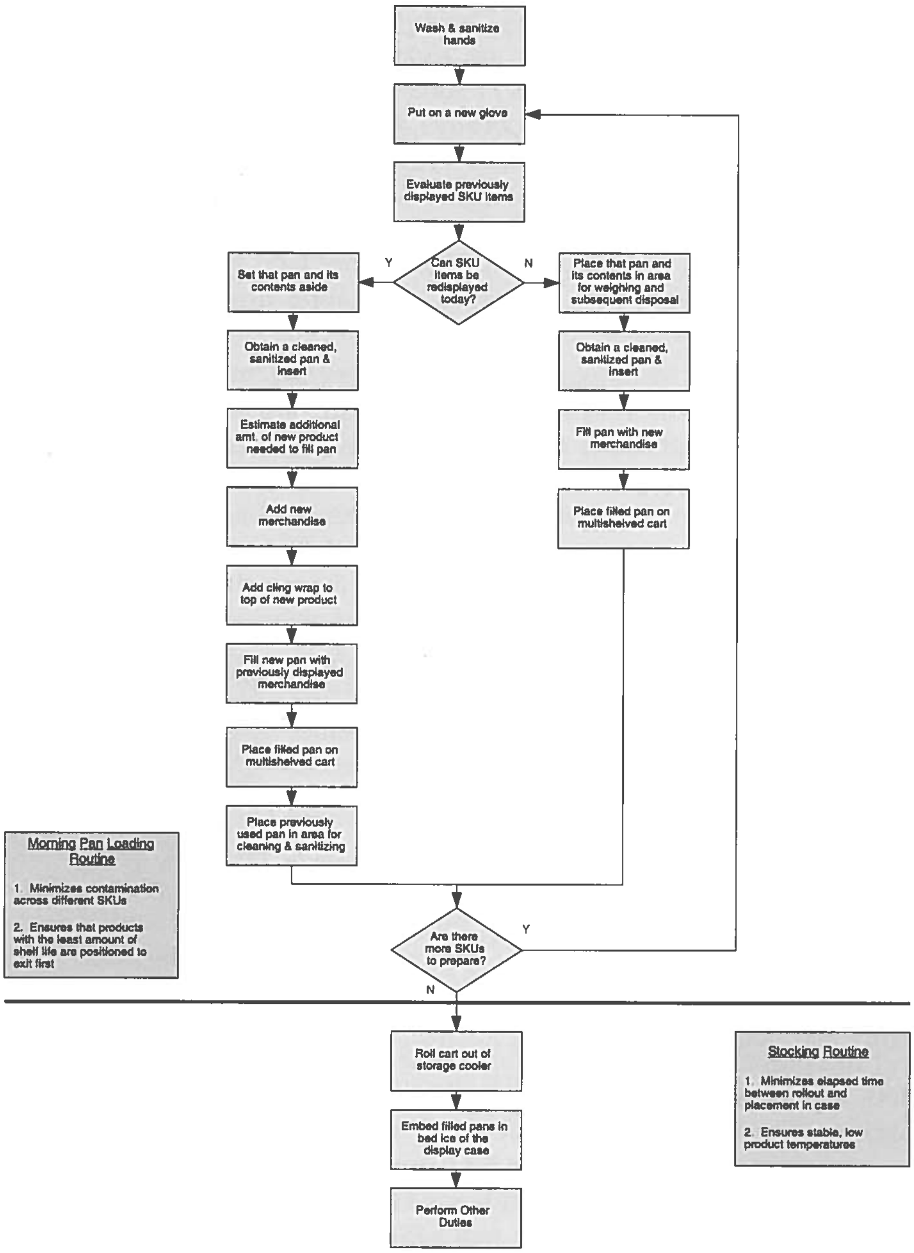


Fig. 5-12. Stepwise procedure for loading pans from a walk-in cooler that minimizes inadvertent contamination among SKUs and ensures a first in—first out rotation sequence.

Ensuring A First-In—First-Out (FIFO) Stock Rotation Plan

The morning employee charged with readying the department is initially confronted with at least two classes of inventory: items that were previously displayed but unsold at the close of business the previous evening, and merchandise held in refrigerated storage since receipt. To prepare each SKU for display while ensuring a FIFO rotation sequence, the procedure outlined in Figure 5-12 is required. (For departments which use a reach-in storage cooler a slightly different sequence is required to minimize heat gain. This sequence is presented in Figure 5-13.) Note that

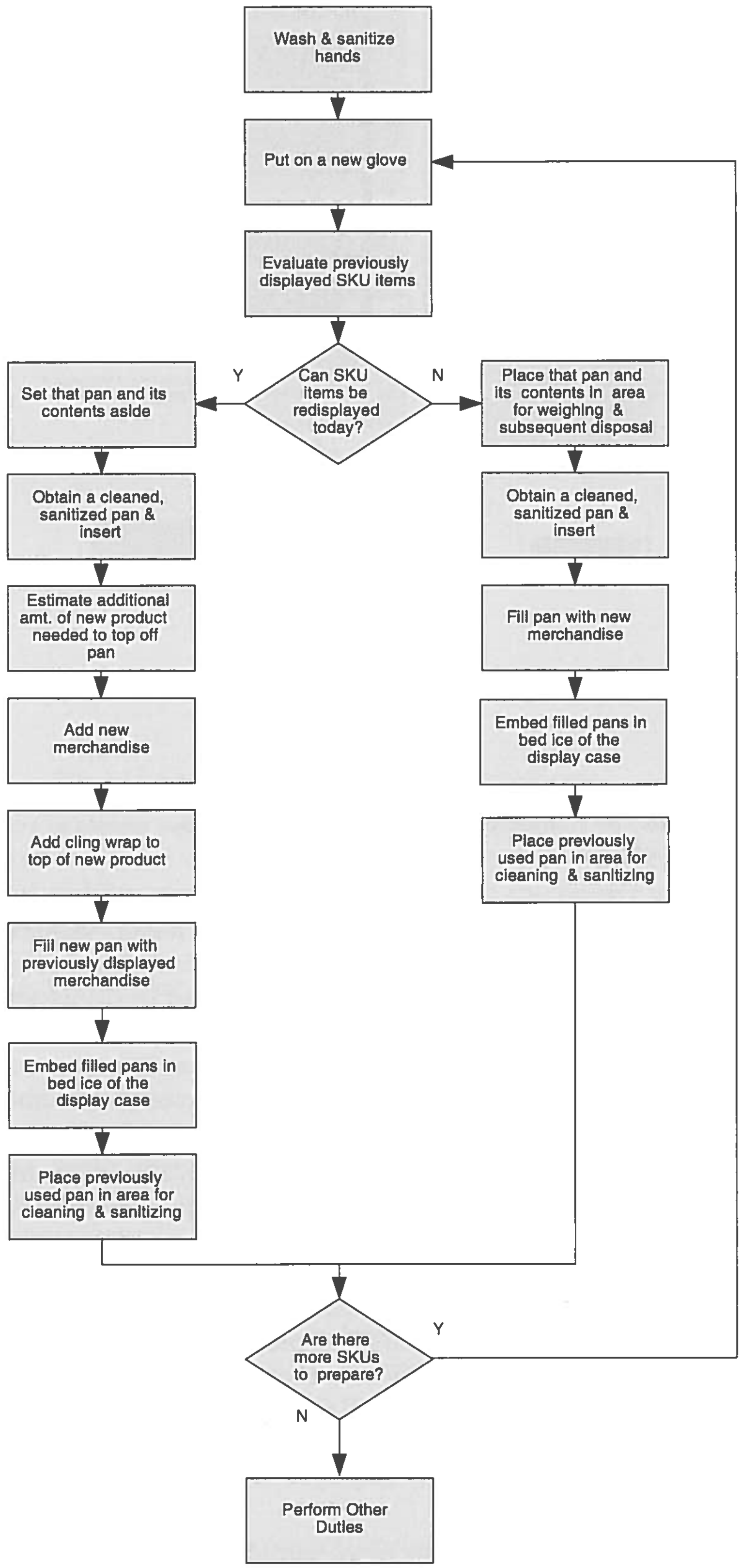


Fig. 5-13. Stepwise procedure for loading pans from a reach-in cooler that minimizes inadvertent contamination among SKUs and ensures a first in—first out rotation sequence.

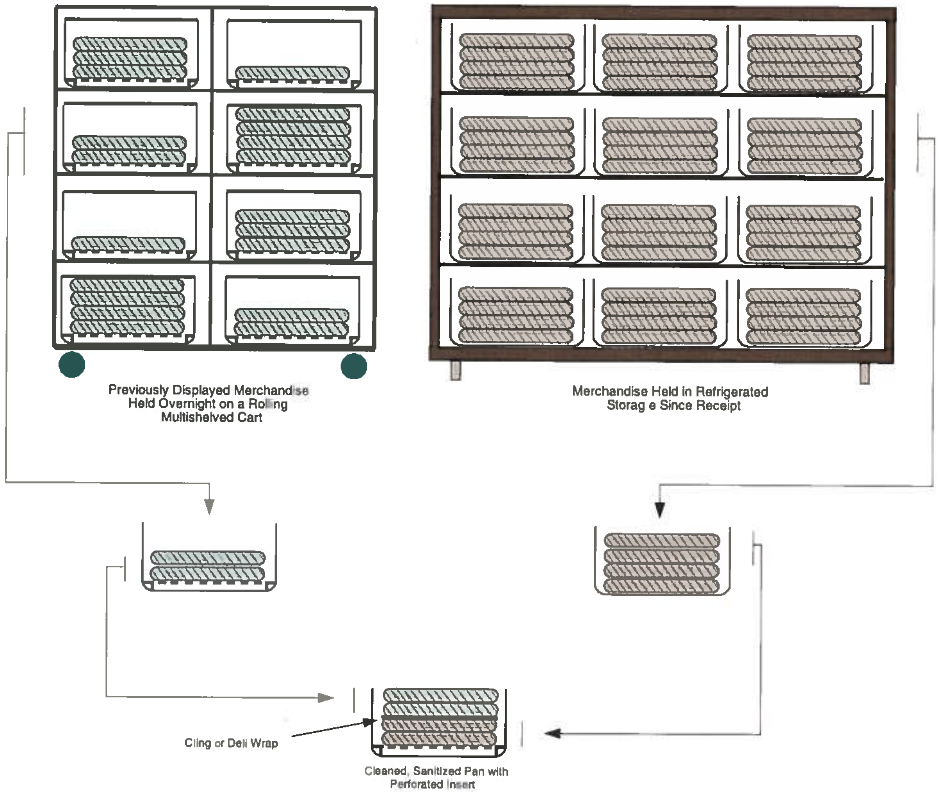


Fig. 5-14. Using pans to ensure a first in—first out stock rotation plan when each SKU may be comprised of previously displayed but unsold merchandise and items held in storage since receipt.

the sequence of activities begins anew with each SKU, requiring a glove change prior to handling the next SKU. The first decision to make is whether the previously displayed merchandise can be displayed again. If it cannot, the employee should set that pan aside, obtain a cleaned, sanitized pan and insert, and fill the pan with "new" merchandise. Of course, if more than one batch of an SKU exists in inventory, the employee should check the arrival dates so that the one delivered first is used first.

If the employee judges that previously displayed merchandise can be redisplayed another day, he then estimates the quantity of "new" product needed to fill the pan that currently contains the previously displayed but unsold merchandise. He then obtains a cleaned, sanitized pan and insert, adds the new merchandise (ensuring that if more than one batch of an SKU exists, the older one is used first), places cling film or deli wrap over the new merchandise, and finally adds the previously displayed items from the other pan. Using this procedure, each pan is loaded so that previously displayed merchandise exits first. Figure 5-14 illustrates the loading procedure, assuming both previously displayed and new merchandise comprise an SKU.

Cling film or deli wrap serves two purposes. First, it provides a barrier between previously displayed but unsold merchandise and the newer items contained below. Second, the barrier acts as a visual cue to employees about how much of a previously displayed but unsold SKU remains af-

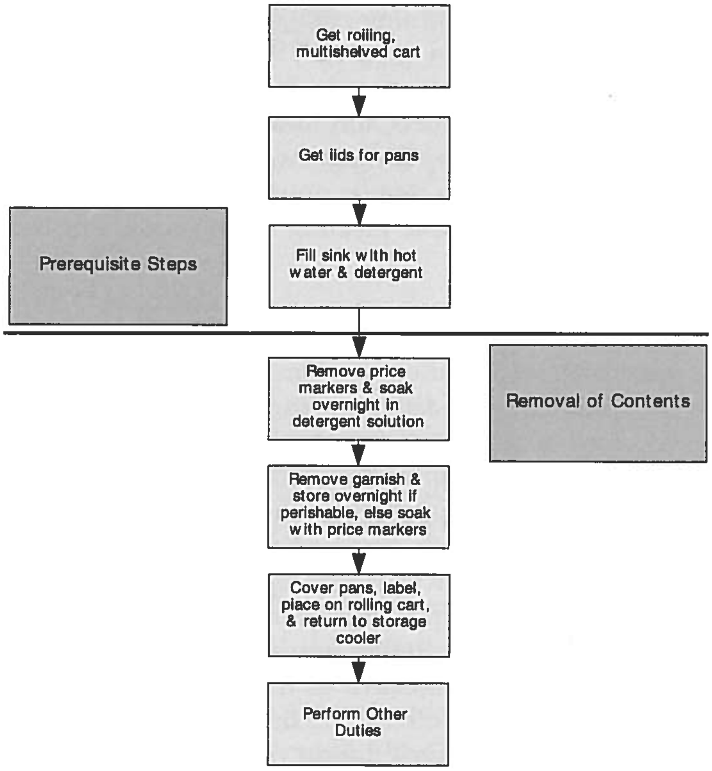


Fig. 5-15. Close down routine for the service case.

ter a subsequent day on display. If the firm had a policy that items would only be displayed for two days and then discarded, the barrier would prevent the accidental discard of items displayed for only one day.

Minimizing Accidental Contact Among Microbiologically Dissimilar Items

Contact among different SKUs during setup or closedown generally occured because the employee completed all like tasks at the same time. This type of work plan is generally known as the functional approach. For example, the audits revealed that during morning setup, each SKU was evaluated, "washed," and stocked without a hand wash or glove change between batches. Virtually the same work pattern was observed during closedown. With the shelf life dissimilarities found across the seafood product line, the functional approach may be expeditious for the employee, but unfortunately the time savings are often traded off in the form of avoidable, accelerated spoilage that begins when different SKUs contact one another. Importantly though, the pan loading routine outlined in Figures 5-12, 5-13, and 5-14 uses an SKU approach that *eliminates* the inadvertent crossover and subsequent contact among microbiologically dissimilar products during setup.

Using pans also prevents contact during closedown (Figure 5-15). Rather than sequentially removing each saleable item one piece at a time, the employee can place a lid on each pan, remove each pan from the case, and place it on the multi-shelved rolling cart that can be wheeled into the walk-in cooler. The afternoon/evening employee never has to handle individual inventory items. With this approach, the push to be "off the clock" and the need to prevent accidental contact among microbiologicaly dissimilar items or between products and insanitary food contact surfaces are not seen as diametrically opposing goals because the display case can be unloaded—one pan load at a time as opposed to one saleable item at a time—in just a few minutes while meeting the objectives of the preventive strategy.

Maintaining Optimally Low Product Temperatures

Properly operating refrigeration systems maintain product temperatures below the maximum mandated holding temperature for refrigerated foods. However, even at temperatures that meet public health mandates, *multiple* shelf life hours can still be lost with each elapsed hour. Because many seafoods arrive with relatively few shelf life hours remaining, and because of the time lag generally required before a previously displayed item sells (18 to 21 hours), small increases in the rate that shelf life is consumed during display can add up to significant losses that are, for the most part, avoidable. Therefore, maintaining low product temperatures during case residence time is a key objective of the Standard Operating Procedure. This section has two objectives. The first demonstrates how best to achieve low product temperatures during case residence times across a range of ambient conditions typical of multi-unit operations. The second examines the effect that slight modifications in the proposed SOP have on product temperature and thus shelf life consumption rates.

The Importance of Embedding Pans in Ice. In the section addressing ice-only cases, the point was made that air temperature 2 inches above bed ice was virtually the same temperature as the store. Thus, to maintain low product temperatures in this type of equipment only two choices exist: (a) periodically top-ice unprocessed inventory such as whole, drawn, or headed and gutted finfish products or shell-on, headless shrimp or (b) embed containers in ice up to the bottom of the lid. Although refrigerated cases do control case airspace temperature, the stocking procedures used in ice-only equipment are also appropriate for the refrigerated service case.

Ice is most effective at removing heat when it melts over the product. As illustrated in Figure 5-1, direct contact with melting ice chills products almost 10 times faster than cold air. However, allowing ice to melt over ready-to-eat items and processed raw products like skinless fillets, steaks, peeled shrimp, etc. is a *mistake* because these market forms can absorb some of this ice melt. Therefore, products and ice need to be physically separated with a pan. Once ice and product are separated, chilling from ice must occur through indirect means.

The first indirect effect is conduction of heat out of the product and into the bed of ice that acts as a heat sink. Accessing this heat sink requires some type of heat exchanger. In this instance, a heat exchanger can be any dense material such as a stainless steel or high-density plastic steam table type pan. Essentially conduction occurs from the product, through the container material and into the bed of ice. Because the effects

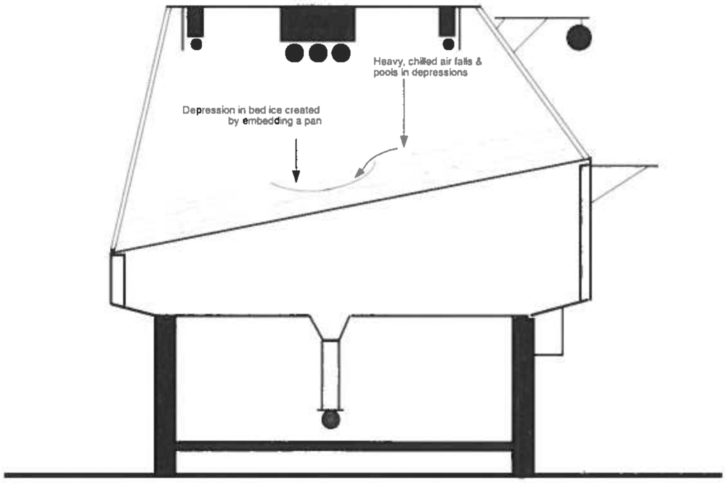


Fig. 5-16. Movement of chilled air into depressions created in bed ice by embedding display pans in ice.

Embedding pans in ice assures the product will remain cold even as ambient case airspace temperatures fluctuate with compressor cycling.

of conduction are limited to that surface area that contacts ice, the efficiency of the pan as a heat exchange device is proportional to the surface area exposed to the heat sink. Thus, the more surface area exposed to bed ice — in this case the sides and the bottom of the pan — the better the heat removal potential.

When pans are embedded in bed ice, products remain at optimally cold temperatures over a wide range of preset ambient case airspace conditions. At the end of the day, employees can place a lid on each pan, place the pan on a multi shelved rolling cart, and return the entire cart to refrigerated storage without ever handling individual items. This sharply reduces indirect contamination across SKUs.

Embedding pans in ice, as opposed to placing them on ice, is important for another less obvious reason. As Figure 5-16 illustrates, when air is chilled via refrigeration systems, it becomes dense and cascades downward toward the product. At the air/ice interface this air is further chilled and becomes heavier. Being dense, this chilled air sinks into depressions in the ice *when pans are embedded in ice*. Importantly, when most SKUs like fillets, steaks, shrimp, etc. are loaded into pans, airspaces within the pan are unavoidably created. So long as the pans are embedded in ice, cold air will pool in these airspaces and buffer the product from warmer ambient case temperatures.

Embedding pans in ice does have a positive effect on temperature control, but to what extent? The following experiment was conducted to evaluate temperatures that result from embedding pans in bed ice or placing pans on ice. Once pans were configured in the case, an array of thermocouples was arranged along the center axis of each pan to measure the air temperature at different vertical distances from the pan bottom (0.5 inch, 1.0 inch, and 1.5 inches) over seven hours (Figure 5-17). Case airspace temperature was simultaneously measured about 2 inches below the coils at the top of the case.

During the 7-hour trial, the case airspace averaged 53.6°F. When all temperature data for each pan were summarized, the average air temperature in pans placed on ice was 44.4°F while the average air temperature of

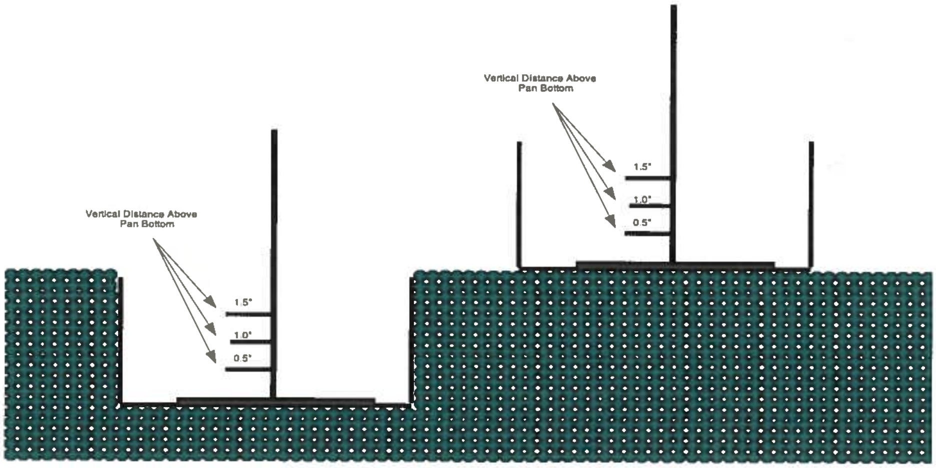


Fig. 5-17. Thermocouple configuration used to measure pan air temperature at different heights above pan bottoms.

pans embedded in ice was 37°F. Embedding pans in ice resulted in an average pan air temperature that was 7.4°F lower than when pans were placed on ice.

Besides the average pan air temperatures being different over the 7-hour trial, the temperature histories of the two treatments through time were also very different. For presentation purposes, the temperatures recorded at the three vertical distances in each pan treatment were averaged into a single "pan" value for each 30 minute interval. These summary data points are presented graphically in Figure 5-18. As the figure illustrates, the temperature profile of pans placed on ice varied in close harmony with case airspace temperature as the compressor cycled during the day. For example, between 5.0 and 5.5 hours elapsed time, case airspace temperature increased by 12.5° F while the average air temperature in pans placed on ice concomitantly increased by 6.4° F. During the same 12.5° F increase in case temperature between five and 5.5 hours, air temperature in pans embedded in ice remained constant. Thus, pans embedded in ice returned a profile best described as *consistently* low during the 7-hour trial.

Pans placed on ice take limited advantage of the heat sink offered by bed ice. A pan with dimensions 11 inches x 9 inches x 6 inches has 339 square inches of surface area available as a heat exchanger. However, most of the pan surface is in the sides (77 percent) so these deep pans must be embedded in ice to take full advantage of the heat transfer potential. There is another reason for embedding the pan in ice. Ambient case temperatures prevail one to two inches above bed ice. These ambient conditions can dramatically fluctuate over time as the compressor cycles. Placing a 6-inch-deep pan on ice exposes more than two-thirds of the vertical capacity of the pan to this zone of the case.

Thus, when pans are embedded in ice, the air temperature in the pans is low and constant despite sharp changes in case temperature. However, that conclusion was based on one ambient case airspace setting; yet, multi-unit operations seldom have identical equipment. To verify experimental

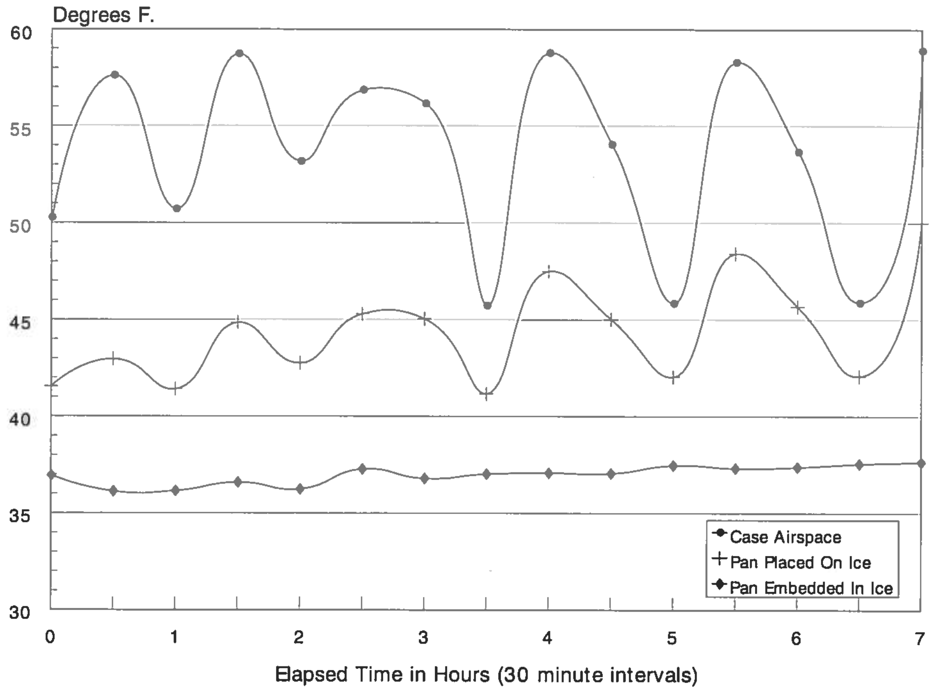


Fig. 5-18. Air temperature in pans when placed on ice or embedded in ice in an American style service case.

Empty display pans embedded in ice maintained a temperature that averaged 7.4°F lower than an identical pan placed on top of the bed of ice.

results over the range of temperature observed during the audits, a subsequent experiment with product was designed to evaluate how consistent the performance of this stocking procedure was over a range of case airspace conditions (controls set to average 40°F, 50°F and 60°F over time). Each of these ambient environments varies over time—particularly at the lower settings—but each setting returned an average temperature roughly equivalent with the planned, preset case airspace temperature (Figure 5-19, page 88).

Despite an approximate 20°F difference between the highest and lowest case airspace temperatures, embedding pans in ice resulted in product temperatures that, on average, varied by just 3.7°F over 9.5 hours (Figure 5-20, page 88). Even at the 60°F setting, the average temperature of products over the trial was below the maximum permissible holding temperature for refrigerated foods established by public health authorities. Therefore, embedding pans in ice can buffer products against a wide range of ambient case conditions by simultaneously maximizing the heat transfer potential and taking advantage of the cold air barrier created with this stocking procedure.

These two experiments show that constant, low temperatures can be achieved when products are placed in pans and these pans are embedded in ice up to the lip of the container. Three important conclusions were drawn from these trials:

- pans embedded in ice return lower *average* temperatures during case residence time than pans placed on ice,
- a more *constant* temperature is obtained during case residence time when pans are embedded in ice,

Case airspace temperature profiles at three thermostat settings showing the effects of compressor cycling.

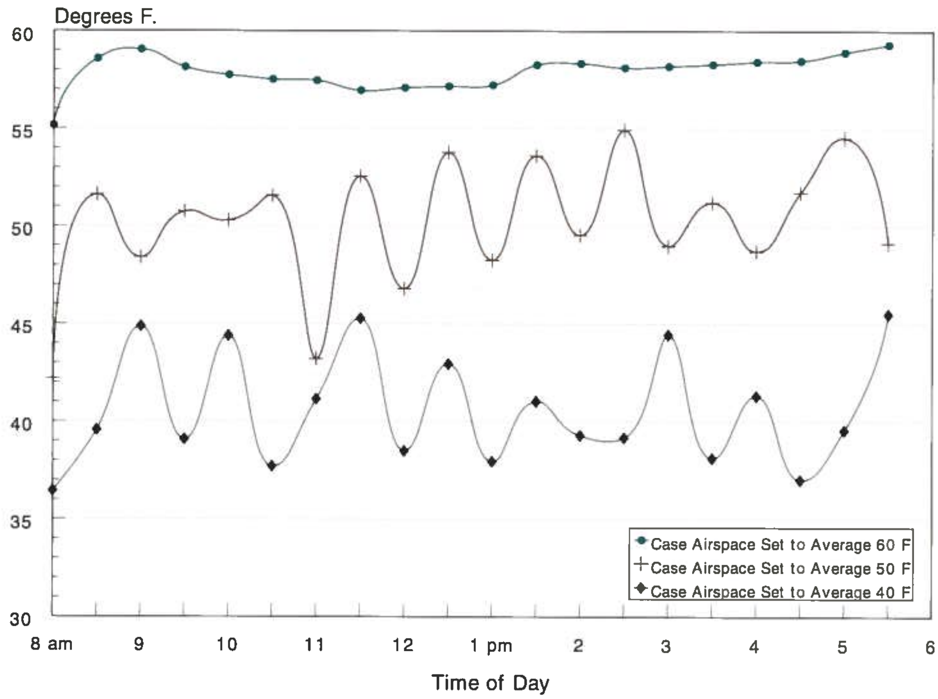


Fig. 5-19. Ambient case airspace temperature profiles.

When display pans are embedded in ice, optimally low product temperatures can be maintained regardless of preset case airspace temperatures.

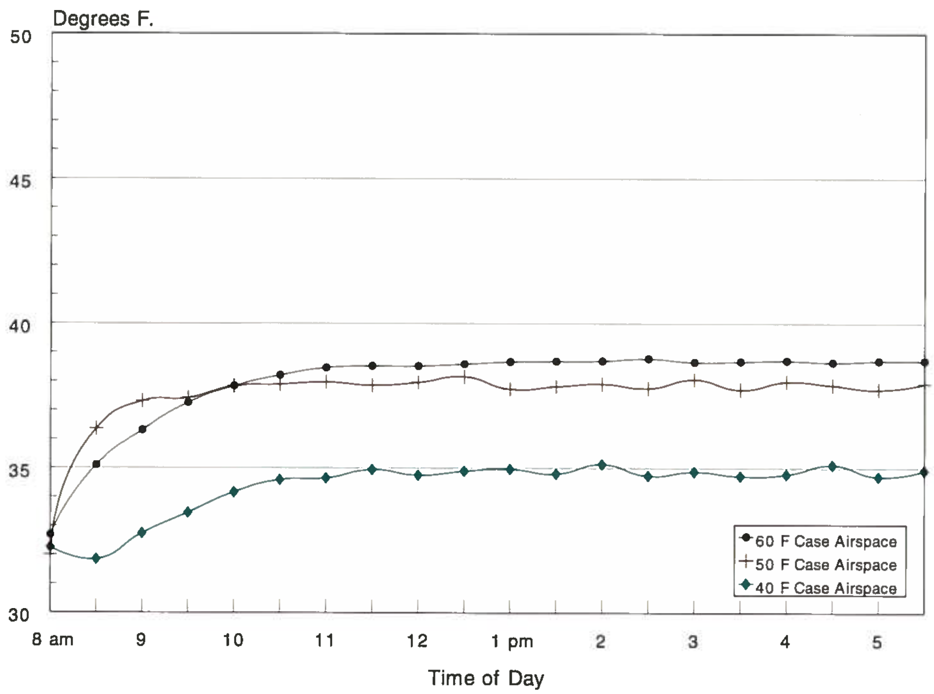


Fig. 5-20. Temepratture histories of products placed in steam table pans and embedded in ice over three different case airspace settings.

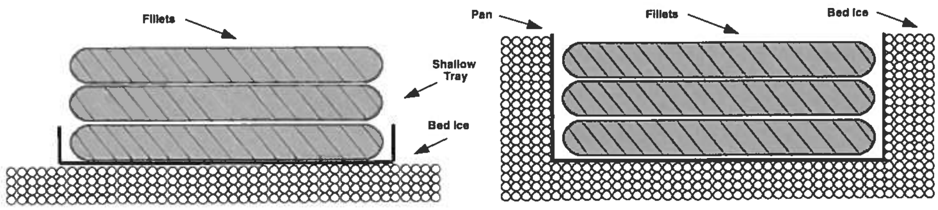


Fig. 5-21. Cross-sectional view of shallow tray on ice and a steam table-type pan in ice.

- when pans are embedded in ice and exposed to a wide range of preset ambient case conditions, the variation in average product temperature across different ambient conditions is *minimal.*

The last point has significant importance to the retail food sector because it indicates that one stocking procedure can maintain constant, low temperatures despite ambient case airspace conditions—an important managerial objective of the Standard Operating Procedure for bulk packed inventory.

The Effect of Slight Deviations from the Proposed SOP on Product Temperature

Steam table type pans with lids and perforated inserts are at the heart of the Standard Operating Procedure proposed for bulk-packed inventory items. Likewise, proper use of this equipment has been demonstrated by reviewing temperatures generated by placing pans on ice versus embedding them in ice. While there is some flexibility in pan type, achieving constant, low product temperatures is determined by close adherence to the SOP. Nevertheless, experience suggests that without objective information about why a procedure should be carried out as specified, subtle, seemingly trivial modifications often find their way into the SOP and performance ultimately suffers. Importantly, the physical effects of these subtle changes in procedure are generally imperceptible without monitoring equipment that is generally beyond the scope of retail operations. Nevertheless, the economic effects of these slight deviations are real; generally reducing the length of time available to market the product thereby increasing avoidable shrink.

What follows is a comparison of two subtle modifications made in the suggested SOP. The first examines the performance differences obtained when displaying products in a shallow plastic tray with roughly one inch sides placed on ice compared to a deeper steam table type pan embedded in ice. The other comparison explores the temperature differences realized when using a perforated insert that holds the product about 1/4-inch off the pan bottom compared against two upturned 2S foam trays that also hold the product approximately one inch off the pan bottom. Both subtle modifications are actual retail practices.

A shallow tray versus a steam table pan. In this simulation of actual departmental operations, steam table type pans embedded in ice were compared against shallow trays placed on ice (Figure 5-21). A stack

When products are placed in shallow trays that rest on bed ice, average product temperatures are about 4°F higher than products held in deeper steam table pans embedded in ice. Using the deeper pans embedded in ice will allow the grocer to offer the product through the peak sales window the next day instead of prematurely discarding it.

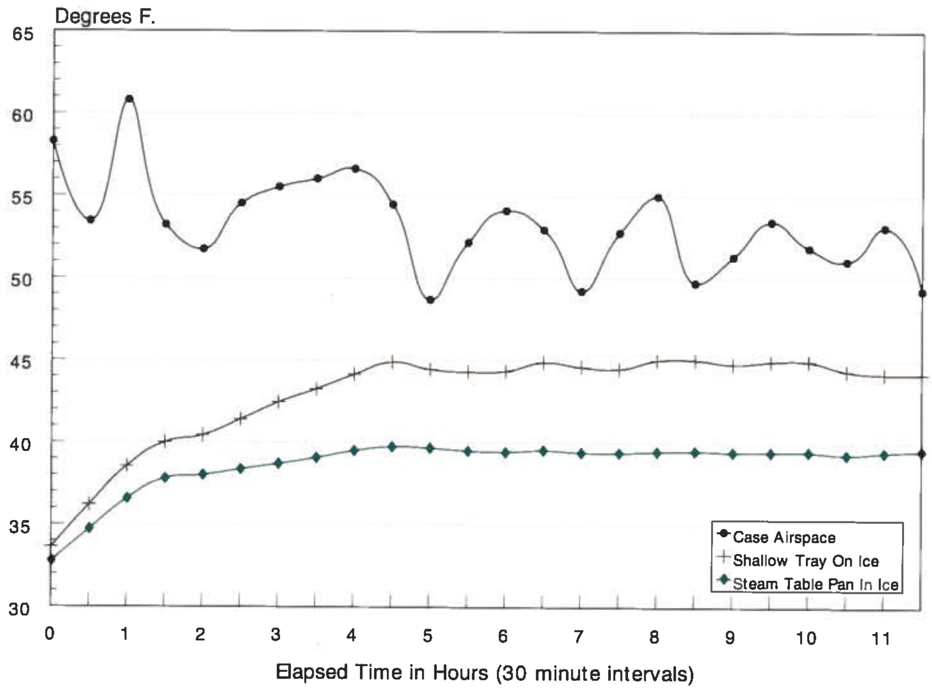


Fig. 5-22. Temperature histories of products held in shallow trays placed on ice compared against pans of product embedded in ice.

of three fillets was evaluated in both treatments. At the commencement of this trial, case doors were removed for a period of 1.5 hours to simulate steps completed to load the case and the elapsed time necessary to do so. Case airspace was set to average 50° F, the actual temperature recorded during one of the original prototype audits. Figure 5-22 illustrates the temperature histories generated through this experiment. Products held in the shallow tray returned an average temperature over the 12-hour trial of 42.8° F while the average temperature of products held in the steam table pans that were embedded in ice was 38.6° F.

The practical effect of this difference in average product temperatures is real, affecting the length of time available to market previously displayed products (Tables 5-6 and 5-7). In this particular simulation, products held in the shallow tray would lose 35 hours of remaining shelf life over a 14-hour case residence time. Conversely, product displayed in steam table pans embedded in ice would lose 25.2 shelf life hours. Assuming that products arrive with 78 net shelf life hours remaining (i.e., 88 total shelf life hours remaining with 10 subtracted upon receipt for consumer use), the grocer has but five hours the second day to sell products merchandised in the shallow tray that did not sell the first day they were displayed. On the other hand, if the products stocked in steam table type pans do not sell the first day, the grocer has virtually all of the second day to sell the product. Importantly the time available to sell previously displayed merchandise held in steam table type pans coincides with the entire peak sales period. This provides greater assurance that the items can be sold rather than discarded.

Table 5-6. Time Available to Sell Product When Displayed in a Shallow Tray On Ice

Day	Retail Activity	Beginning Shelf Life	Elapsed Hours	Product Temperature	Hourly Rate of Spoilage	Shelf Life Hours Used	Net Shelf Life Remaining
D-0, 11 am	Product accepted and placed in cooler until 7 am the next day.	78.0	20.0	32.0	1.0	20.0	58.0
D-1, 7 am	Manager removes item from storage and places it on display until 9 pm	58.0	14.0	42.8	2.5	35.0	23.0
D-1, 9 pm	Unsold merchandise is returned to cooler until 7 am	23.0	10.0	32.0	1.0	10.0	13.0
D-2, 7 am	Previously displayed item returned to display	13.0	5.2	42.8	2.5	13.0	0.0
D-2, 12 pm	If not sold by 12 pm, manager discards item						

Table 5-7. Time Available to Sell Product When Displayed in a Steam Table Pan Embedded in Ice

Day	Retail Activity	Beginning Shelf Life	Elapsed Hours	Product Temperature	Hourly Rate of Spoilage	Shelf Life Hours Used	Net Shelf Life Remaining
D-0, 11 am	Product accepted and placed in cooler until 7 am the next day.	78.0	20.0	32.0	1.0	20.0	58.0
D-1, 7 am	Manager removes item and places it on display until 9 pm	58.0	14.0	38.6	1.8	25.2	32.8
D-1, 9 pm	Unsold merchandise is returned to cooler until 7 am	32.8	10.0	32.0	1.0	10.0	22.8
D-2, 7 am	Previously displayed item returned to display until 9 pm	22.8	14.0	38.6	1.8	25.2	-2.4
D-2, 9 pm	Unsold merchandise is returned to cooler						
D-3, 7 am	Manager discards item						

Perforated inserts versus upturned, foam meat trays placed in display pans. This comparison evaluates the use of perforated inserts against a more traditional and readily available item in the market: a polystyrene overwrap tray. The reason behind using each type of insert differs. Traditionally, false bottoms have been used by some retailers to provide the illusions of a full case, while actually stocking fewer layers of product (Figure 5-23 left panel). This was viewed as perhaps the best way to meet merchandising goals of a full case while actually displaying less product in departments experiencing slow sales (i.e., the elapsed time between initial stocking and sale is long so physical inventory turnover is slow). On

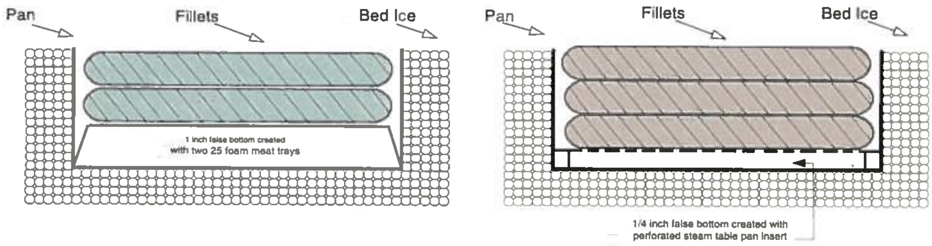


Fig. 5-23. Cross-sectional view of two configurations that separate products from pan bottoms.

the other hand, the use of a perforated insert has little to do with presenting fewer layers of merchandise (Figure 5-23, right panel). Rather, the purpose of the perforated insert is to hold the product slightly off the pan bottom so that product and drip are separated. This separation enables the pan itself to act as a catchment basin instead of the catchment pan integrated in the display case (refer to Figure 5-6, page 68). The benefit of catching all drip in a pan that is removed each day is threefold. First, product is separated from accumulated drip; a desirable condition, positively affecting both eye appeal and shelf life. Second, the frequency of disassembling, cleaning and sanitizing the display case can be sharply reduced since individual pans hold all product drip while the integrated catchment pan receives only melted ice. Third, odor control is more effective since containers are cleaned and sanitized each day.

In this performance trial, all pans were embedded in ice. The only differences were the material used as a false bottom, and the vertical distance that separated the product from the pan bottom. Regardless of the preset ambient conditions, products displayed atop upturned polystyrene meat trays that were used as false bottoms consistently approached ambient case airspace settings (Figure 5-24). Conversely, when products are placed on the perforated insert inside the pan that was subsequently embedded in ice, the average product temperature under a 40°F ambient setting remained relatively constant during the 9-hour trial.

As indicated in Figure 5-24, product used in the trial with upturned foam trays began at an optimal temperature, but by the end of the 9-hour trial had reached 40°F — the preset case airspace temperature. On the other hand, product used in the perforated insert trial began slightly warmer at about 35°F, but gained only 1.3°F in nine hours. There are two reasons for the differences in the amount of heat gained during case residence time. First, polystyrene (a closed cell foam) is an excellent insulator. Using it as a base renders the pan bottom ineffective as a heat exchanger, preempting the opportunity for heat to be transferred from the fillets, through the pan bottom, and into the bed ice. Second, the false bottom created by the foam trays (about 1 inch) held product above the cold air barrier created in the bottom half of the pan, even when pans are embedded in ice (Figure 5-16, page 85).

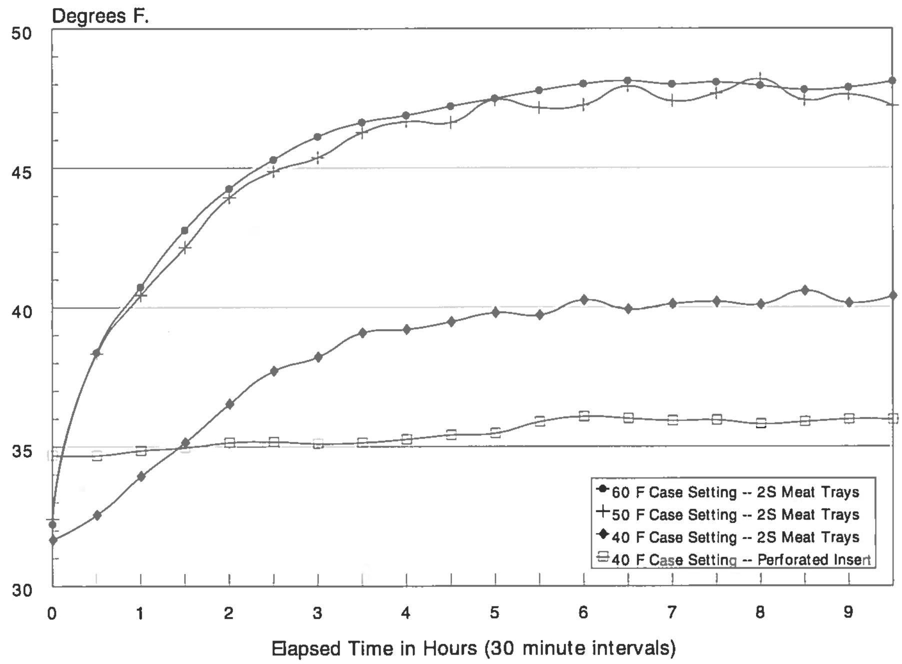


Fig. 5-24. Average product temperatures when stocked on two upturned 2S trays placed in steam table pans and on perforated inserts, all of which were embedded in ice.

Polystryene display trays should never be used as false bottoms in display pans. In performance trials, products held under this stocking procedure tended to seek ambient case airspace temperatures.

Discussion

The two trials discussed in the previous section evaluated temperature differences that resulted when seemingly inconsequential changes were made to the SOP presented in this chapter. In particular, use of the shallow tray on ice would preempt the grocer from displaying an unsold item through the peak sales period the following day. On the other hand, placing the same product in a steam table pan and embedding it in ice reduces the shelf life consumption rate to the point where that product can remain in the display case for virtually the entire next day. With respect to choosing an insert for the steam table pan, use of a readily available overwrap tray instead of the specially designed insert resulted in an 8° F temperature gain. Halfway through the simulated sales day, average product temperature reached ambient case airspace settings. This suggests that creating a one inch airspace negates both the heat exchanger opportunity and the buffering effects that a pool of cold air has on maintaining product temperature. Conversely, the average temperature of the fillets placed on the perforated, specially made inserts demonstrated almost no gain in temperature. *The important conclusion to remember is that while the physical effects of subtle changes in an SOP are generally imperceptible to the touch, a long holding period between daily sales peaks can magnify such differences thereby increasing avoidable shrink.*

A Summary of the Standard Operating Procedure for Bulk Packed Inventory

The proposed standard operating procedure for bulk packed inventory requires a small investment in steam table type pans, lids and inserts for each department. The type of container material is an individual choice. Similarly, width and length of these containers should correspond to the expected turnover of each item. *One element in this proposed SOP not open to choice is container depth. All pans should be at least 6 inches deep.* To ensure that an SKU is placed in a cleaned, sanitized steam table pan each morning, duplicate sets of pans are required. That way, one pan unit (a pan and an insert) is always sanitized, and ready for use across the product line.

Aside from steam table type pans, most of the SOP is a redirection of activities. These activities (a) ensure correct stock rotation plans, (b) sharply reduce the opportunities for inadvertent contact among microbiologically dissimilar items or between products and insanitary food contact surfaces that were observed in the audits, and (c) ensure constant, low product temperatures during case residence times. When the flow of work from morning setup through evening closedown is traced, the vast majority of the "behind the scenes" work falls on the shoulders of the departmental manager. This is by design since the departmental manager is among the most senior employees and has the most food handler experience. Therefore, his work routine should center on ensuring that all activities respect the preventive strategy.

The morning pan loading routine is perhaps the best example of skill levels being equivalent with work responsibilities. As illustrated in Figures 5-12, 5-13, and 5-14, the morning pan loading routine, when performed according to specification, ensures that work is done on a product-specific basis. Making this change from the more typical functional approach (where all different SKUs are handled as one step) will sharply reduce — if not eliminate — inadvertent contact among different seafood products. For each SKU, the department manager evaluates previously displayed merchandise and, if it is still saleable, loads cleaned, sanitized pans with this material *last* so it can exit *first*. Once all filled pans are ready for stocking, each pan is embedded in ice which ensures constant, low product temperatures, even when ambient conditions vary within the case as the compressor cycles, or when ambient conditions themselves vary as a function of different types of equipment used throughout the chain.

Conversely, the primary mission of the afternoon/evening employee is to provide customer service since the vast majority of daily sales are made within a two to four-hour time frame. In fact, the close down procedure is the only **routine** "behind the scenes" activity that this employee must complete each day. The closedown procedure is a stepwise process without any decisions or judgements to make (Figure 5-15, page 83). The primary objective of the closedown procedure is to ensure that all objectives of the preventive strategy are met while completing the procedure in the most time-efficient manner possible. As Figure 5-25 illustrates, the only other "behind the scenes" work that may be required of the afternoon/evening employee is to restock SKUs that may sell out before the close of business.

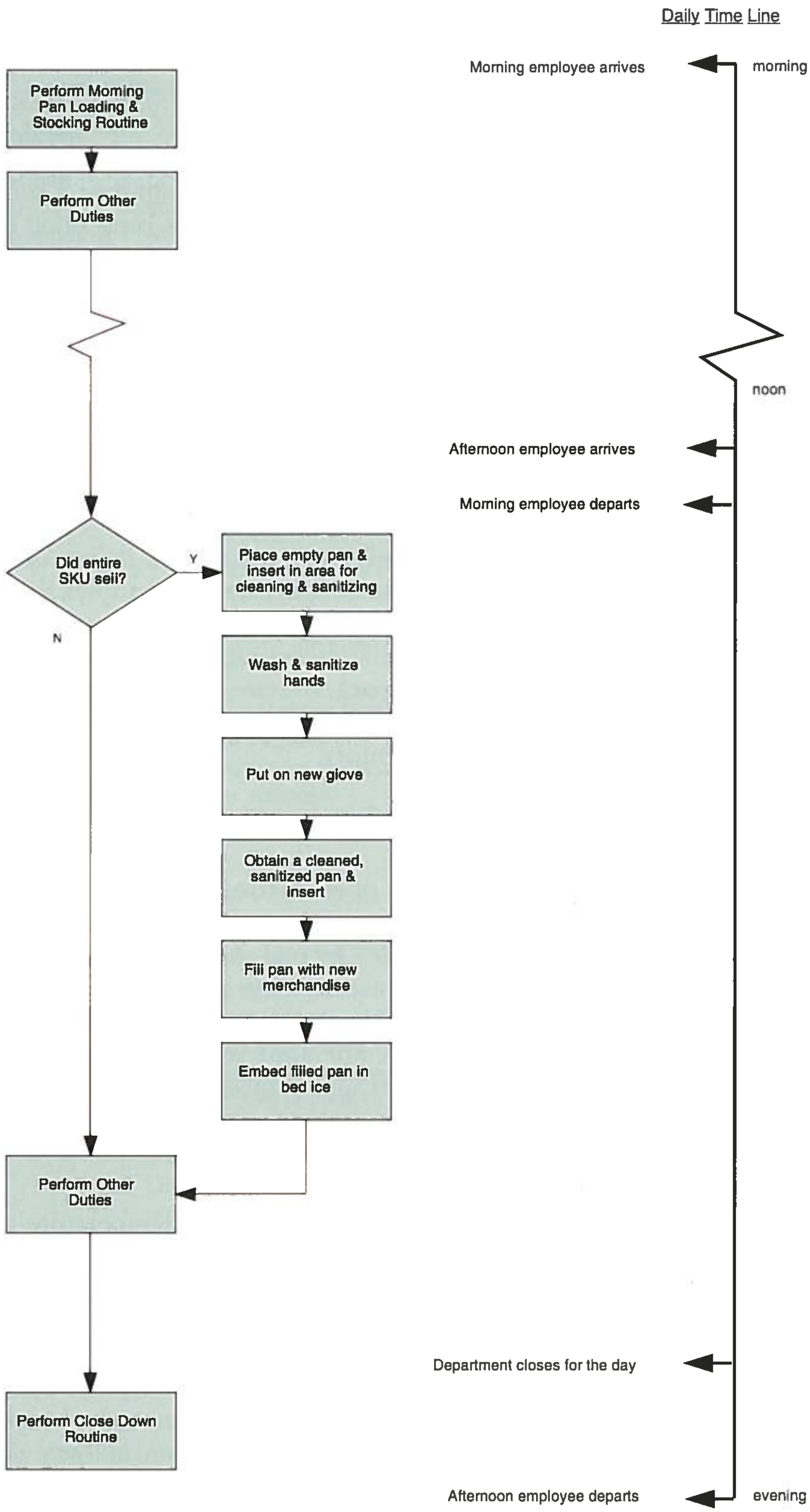


Fig. 5-25. The standard operating procedure for bulk packed inventory superimposed on the daily time line for departmental operations.

A Standard Operating Procedure for Products Arriving in Consumer Packages Displayed in Ice-only Cases

Table 5-8 summarizes the current quality and safety errors made with prepacked products destined for an ice-only display case. This table also sketches a proposed solution that meets (a) the goals established by the preventive strategy and (b) the design guidelines that stipulate a simplified, streamlined approach. Among prepackaged products, preventing contamination during necessary handling is not a concern. However, when refrigerated, ready-to-eat foods are merchandised in an ice-only display case two quality and safety issues remain. The first of these is control of temperature during the display phase of the sales day. This control is imperative because ice-only equipment cannot chill the airspace immediately above bed ice (Figure 5-9, page 71) and chilling via conduction occurs only when ice contacts a container. The second quality and safety objective is identical to bulk- packed inventory, namely, ensuring that items with the least amount of shelf life are positioned to exit first.

As with the SOP for bulk-packed inventory, a common theme can be found in this proposed solution: the use of specially marked totes for segregating previously displayed but unsold merchandise from items held in refrigerated storage since receipt. While steam table type pans are the "heart and soul" of the SOP for bulk packed items, permanently marked totes ensure constant temperature control during storage and proper rotational sequences for containerized inventory.

Maintaining Optimally Cold Product Temperatures During Retail Stewardship

Audits revealed that some packages of ready-to-eat products (crabmeat and shucked oysters) placed on display in the morning had internal temperatures ranging between 50°F and 60°F by mid-afternoon. Such elevated temperatures accelerate spoilage and increase the possibility of compromising product safety. When stocked in an ice-only case, containerized inventory is particularly vulnerable to temperature abuse for two reasons. First, heat transfer is relatively slow because it must occur across several inches from the container wall to the center (or axis) of the container. Second,ambient room temperatures prevail at a vertical distance of one to two inches above bed ice (Figure 5-9, page 71).

Unless containers are surrounded with ice, product temperature may vary at different locations within the container. To assess temperature differences at various locations inside a pint jar (5.25 inches high with a diameter of 3 inches), a series of experiments was conducted. As Figure 5-26 (page 98) illustrates, thermocouples were attached to a vertical rod that passed through a perforation in the lid to the bottom of a jar of oysters. This rod ensured that thermocouples were aligned to measure temperature along the axis of the jar at 1/2 inch above the bottom, midway along the axis (i.e., the geometric center of the container), and 1/2 inch below the top. Once the thermocouple array was positioned, the lid was affixed, and jars were placed upright *on ice* in an open, ice-only self-service case for 9.5 hours.

Table 5-8. Solving Current Quality and Safety Errors within the Prepackaged Product Line Displayed in Ice Only Equipment

SOP Objective	Current Approach Revealed through the Audits	Proposed Solution
Maintain cold product temperatures throughout retail stewardship	Containers held in some refrigerated storage units were not surrounded with ice.	Upon receipt, completely surround containers in original shipping box(es) with ice, and return to the walk-in cooler for refrigerated storage.
	Rolling out uniced containers and waiting before stocking allows packages to accumulate heat that is hard to remove in an ice only display unit.	By holding items in an ice-filled tote, elapsed time between roll out and stocking will not result in heat gain.
	Placing containers on ice in the display unit does not provide for adequate chilling because just 2 inches above bed ice, ambient room conditions prevail. This accelerates spoilage and threatens the safety of ready-to-eat foods.	Embed each container in ice up to the bottom of the jar lid. Periodically redistribute ice around container surfaces so full contact is made, and add more ice as needed.
	Leaving containers in the display case overnight initiates time/temperature abuse as the ice melts away from container surfaces.	Upon close down, place all displayed but unsold containers in a tote marked "Previously Displayed Merchandise", completely surround containers with ice, and return to walk-in cooler for refrigerated storage overnight.
Ensure Proper Rotation of Inventory	**A single display may be comprised of various classes of inventory including previously unsold** merchandise, and items with different date stamps (e.g. suggested use by dates for shucked shellfish, and pack dates for picked crabmeat). Once placed on display, the rate that shelf life is consumed is **different** from that occurring in refrigerated storage, even among products having identical date stamps. Thus, previously displayed items must be separated from merchandise held in storage since receipt.	**Write date received on the "Original Shipping Boxes," keep containers** in these boxes until containers are placed on display. Initially, use containers taken from the "Previously Displayed Merchandise" tote to build the display, then complete the display with items taken from the oldest "Original Shipping Box." Once a container is removed from the "Original Shipping Box," it should **only** be returned to the "Previously Displayed Merchandise" tote at day's end.

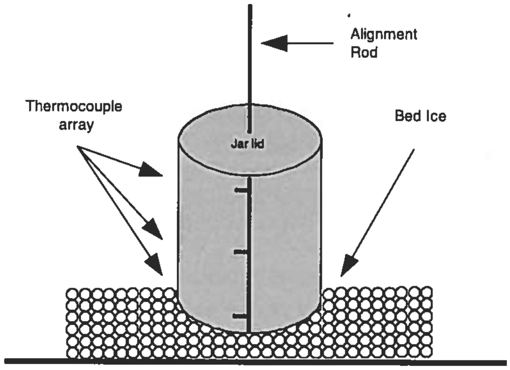


Fig. 5-26. Configuration used to evaluate temperatures at different zones within pint jars of oysters.

Meat temperature 1/2 inch below the top reached 45°F within 30 minutes after stocking while meat temperature at the geometric center reached 45°F within 1 hour. By the end of the second hour on display, temperatures at these two locations had increased to around 50°F. Over the next 7.5 hours, meat temperature at the center and top locations respectively stabilized at 55°F and 60°F (Figure 5-27). Product temperature was acceptable only at the bottommost location within the jars (i.e., that region closest to bed ice). After 3 hours on display, the temperature difference between the top and bottom locations in the jar was roughly 20 degrees. Once purchased, the assumption must be made that the entire package contents will be consumed. Therefore, this evaluation suggests that averaging temperatures collected at three locations within each jar would hide temperatures that *at least* rapidly consume remaining shelf life and *at most* substantially increase the risk of compromising product safety.

Jarred products like shucked oyster meats stocked on ice and displayed in ice-only gondolas exhibit dramatic temperature differences.

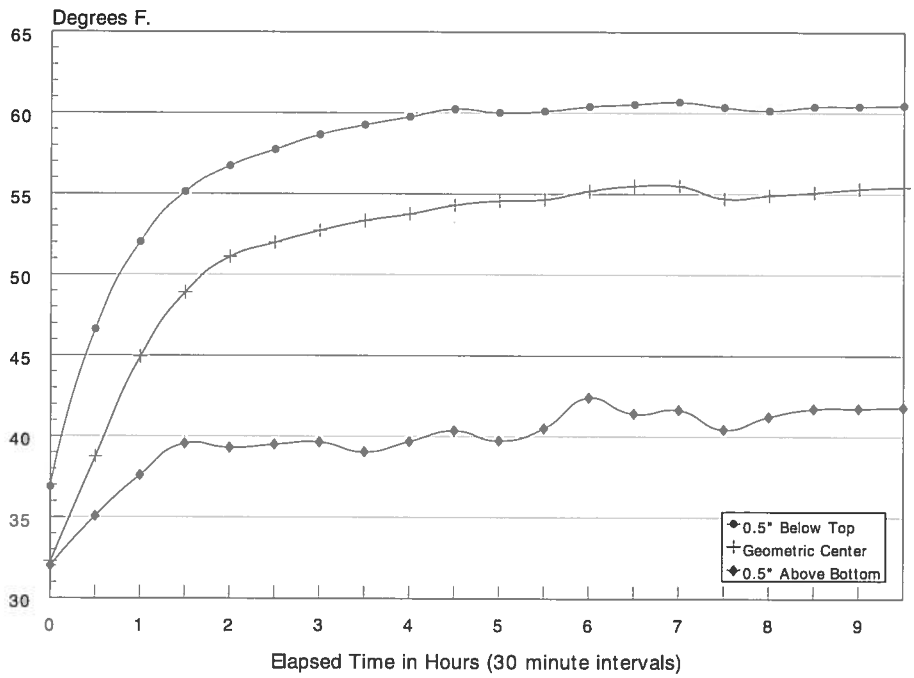


Fig. 5-27. Variation in oyster meat temperature based on vertical distance from the bottom of the pint jar.

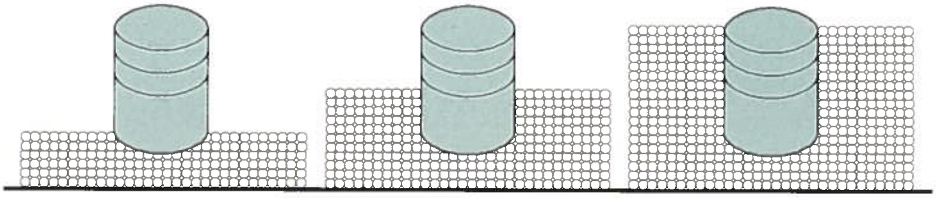


Fig. 5-28. Typical stocking procedures for containerized products held in freestanding, self-service, ice-only gondolas.

Thus, the most conservative location—the top—was used to evaluate the container temperatures that result from stocking pint jars at different depths in ice.

Figure 5-28 illustrates the three common stocking procedures for jarred products: on ice, half in ice, and embedded in ice up to the bottom of the lid. When pint jars are placed on ice, just 11 percent of total jar surface area contacts ice so 89 percent of the surface area is exposed to ambient room conditions. When pint jars are embedded half in ice, 50 percent of total surface area contacts ice. Jars embedded in ice to up the bottom of the lid (with about 3/4 inch of the container above bed ice) maximize the surface area that contacts ice (78 percent), and minimize the proportion that is within the ambient room temperature zone.

Figure 5-29 presents the results of trials evaluating the temperature of jarred oysters one-half inch below the lid when held at the different ice depths illustrated in Figure 5-28. The night prior to the trial, containers were surrounded with ice and stored under refrigeration. As illustrated in Figure 5-29, the initial temperature of all products began at roughly 34°F.

Jarred, ready-to-eat products should be embedded in ice up to the bottom of the lid. This will maximize shelf life and ensure a safe product.

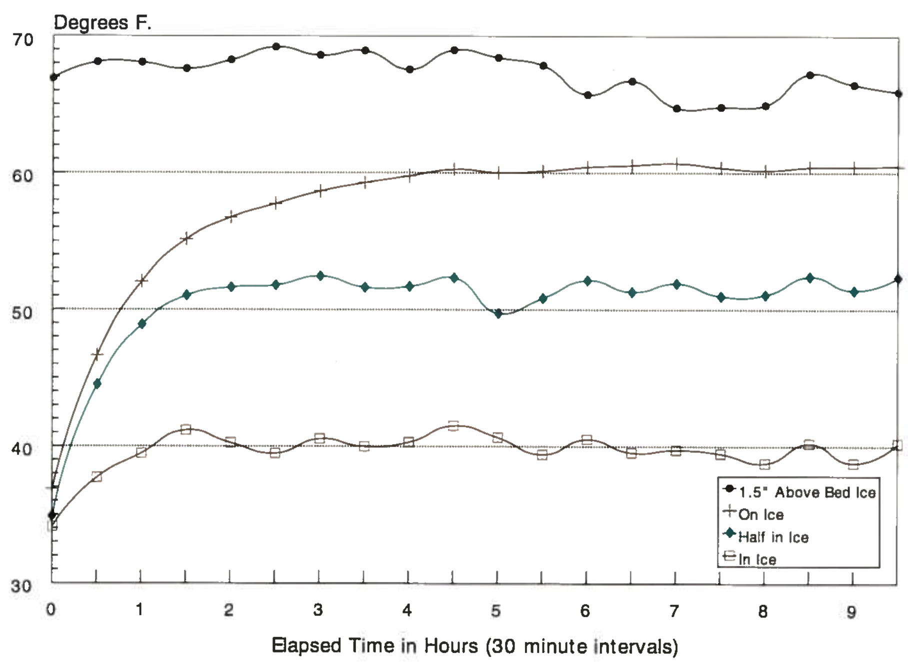


Fig. 5-29. Temperature histories of jarred oyster meats stocked at different depths in ice in a self-service, freestanding, ice-only gondola.

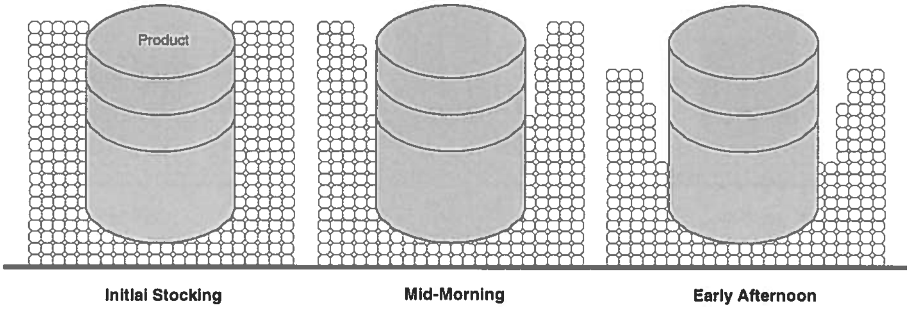


Fig. 5-30. The effect of time on depth of bed ice and contact with container surfaces.

Within the first hour, containers stocked *on ice* and *half in ice* registered temperatures at or above 50°F, and remained at that level for more than seven hours. *Experimental results indicate that embedding the jars in ice is the only stocking procedure which can maintain refrigerated, ready-to-eat merchandise at or below the 41°F temperature mandated by public health authorities when freestanding, ice only merchandising equipment is used.*

The previous discussion highlights the need for embedding containers in ice. Because ice-only cases cannot control the temperature above bed ice, a maximum temperature difference exists between ambient room conditions and ice. This results in continual melting (heat transfer) thus lowering the vertical level of ice. If unchecked, warmer product temperatures result (Figure 5-30). While such changes in the depth of bed ice are obvious, once ice and container become separated the jar becomes ineffective as a heat exchanger and the contents of jars or tubs gradually warm. *Once the ice-only case is stocked, departmental employees should redistribute ice around container surfaces and then add additional ice about every four hours to ensure maximum contact.*

Ensuring a First In—First Out Stock Rotation Plan

Containerized products are frequently merchandised in ice only equipment. When container sides are completely embedded in ice, product temperatures of 40°F can be maintained. Nevertheless, higher holding temperatures result during display so previously displayed but unsold containers must be kept separate from items held in storage because previously displayed items have less shelf life remaining.

Two levels of rotational sequences must be respected. The first ensures that previously displayed products are the first packages to be displayed and sold the following day. With ice-only gondolas, this level of distinction is important even within a given delivery because of the temperature differential between items held in the ice-only case compared with those packed in ice and held in refrigerated storage. As Figure 5-29 (page 99) illustrates, about the *lowest* average product temperature achievable with an ice only display is 40°F; yet, pints surrounded by ice in refrigerated storage can generally be maintained at about 32°F. This difference of 8°F to 10°F between storage and display temperatures combined with a case residence time of 12 hours creates significant shelf life differences between items from the *same* delivery. To ensure that previously displayed merchandise is the first to be redisplayed the next day, retailers need some means of distinguishing previously displayed items from those held in refrigerated storage since receipt. The best way to keep previously displayed inventory separated from other items is to use a specially marked tote. In addition, the morning employee should also "subdivide" the gondola into two sections and place previously displayed merchandise in the front and "new" products in the rear. While not 100 percent effective since customers make their own selections, it may facilitate the previously displayed items being sold first.

The second component of proper stock rotation is to use products with the earlier dates first. Mandatory date stamping of packages such as shucked molluscan shellfish and picked crabmeat enables the employee to distinguish relative age among products. However, the information reflected by the date stamp and the way that the date is presented is *inconsistent* across different products and even within the same product packed in different sized containers. For example, the date stamp found on shucked molluscan shellfish meats packed in less than half gallon containers is the *sell-by* date. The format of this date stamp is usually expressed in a natural typing style (e.g., Oct. 17, 1997). Conversely, when oysters are packaged in containers with at least a half-gallon capacity, the date stamp reflects when the product was shucked. A similar condition holds for all containers of fresh or pasteurized crabmeat. Because this date stamp reflects the pack date, it will *always* be before the date that retailers take possession. Therefore, processors often use Julian dates that express dates as sequential numbers (the Julian date for Oct. 17, 1997 is 35720). Thus, a product with a Julian date of 35720 was packed four days before a product with a Julian date of 35724.

The product flow sequence that respects shelf life differences within and among deliveries is illustrated in Figure 5-31 (page 102). The employee begins by evaluating the contents of the "Previously Displayed Merchandise" tote to ensure that products are within the marketing window (i.e., any items with sell-by dates prior to today's date should be discarded). Initially, the display should be stocked with previously displayed merchandise. The "Previously Displayed Merchandise" tote should be *empty* after the morning stocking procedure since all containers should either be on display or discarded if the sell-by date was exceeded. Any other containers needed to complete the display should be selected from an "Original Shipping Box" with the earliest delivery date.

Upon closedown, unsold items should be returned *only* to the "Previously Displayed Merchandise" tote. Once an item is removed from an "Original Shipping Box" and placed on display, that item should always be returned to the "Previously Displayed Merchandise" tote. Consistent with the SOP for bulk packed inventory, Figure 5-32 (page 103) suggests that any date comparison and loading sequence be performed by the more experienced morning staff member. Similarly, the sequenced stepwise closedown routine presented in Figure 5-33 is easy and time efficient to implement while meeting all preventive strategy criteria.

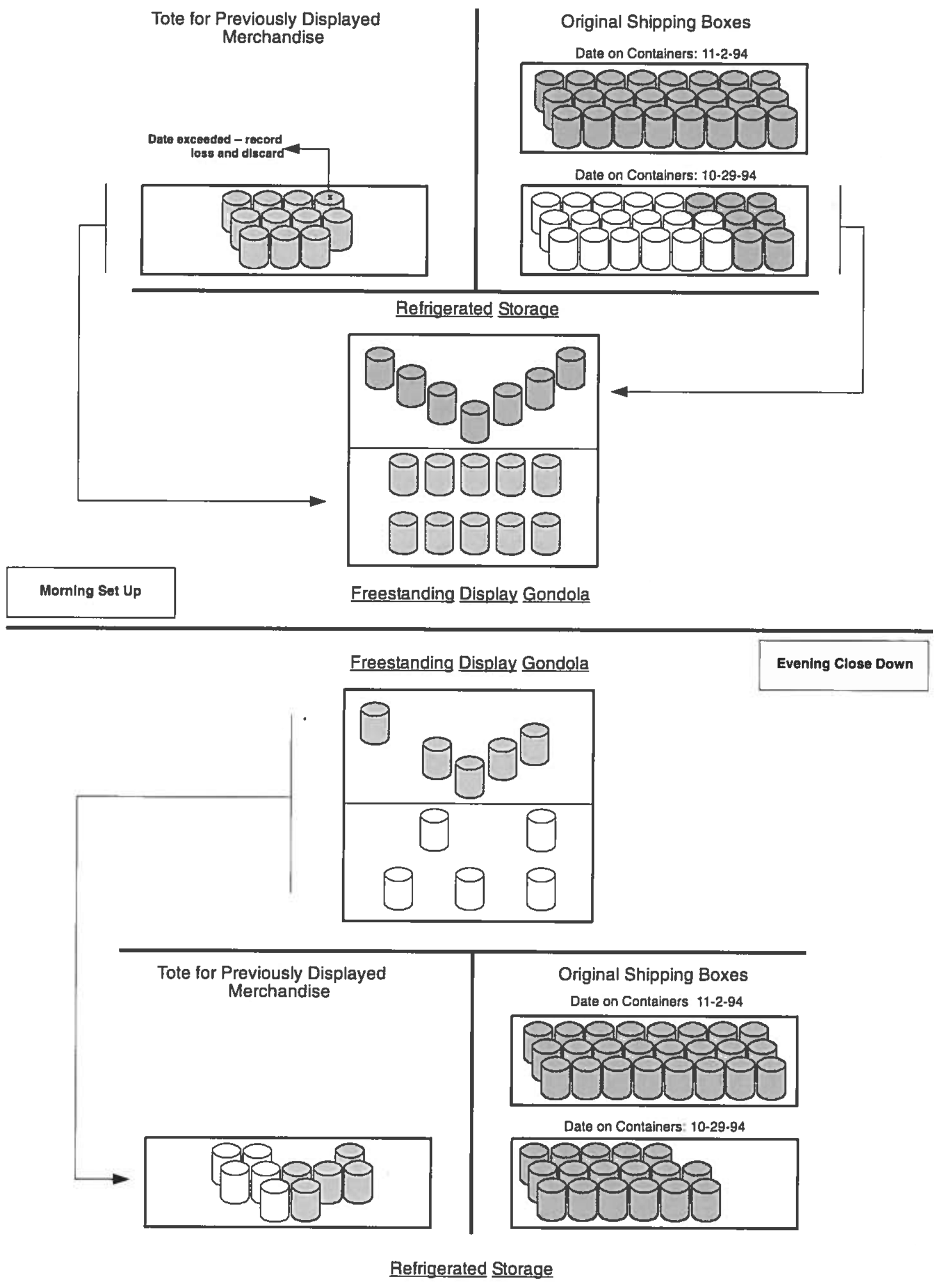


Fig. 5-31. Using original receiving boxes and specially marked totes to ensure a first-in—first-out rotation plan when the display may be comprised of previously displayed but unsold merchandise and items held in storage since receipt.

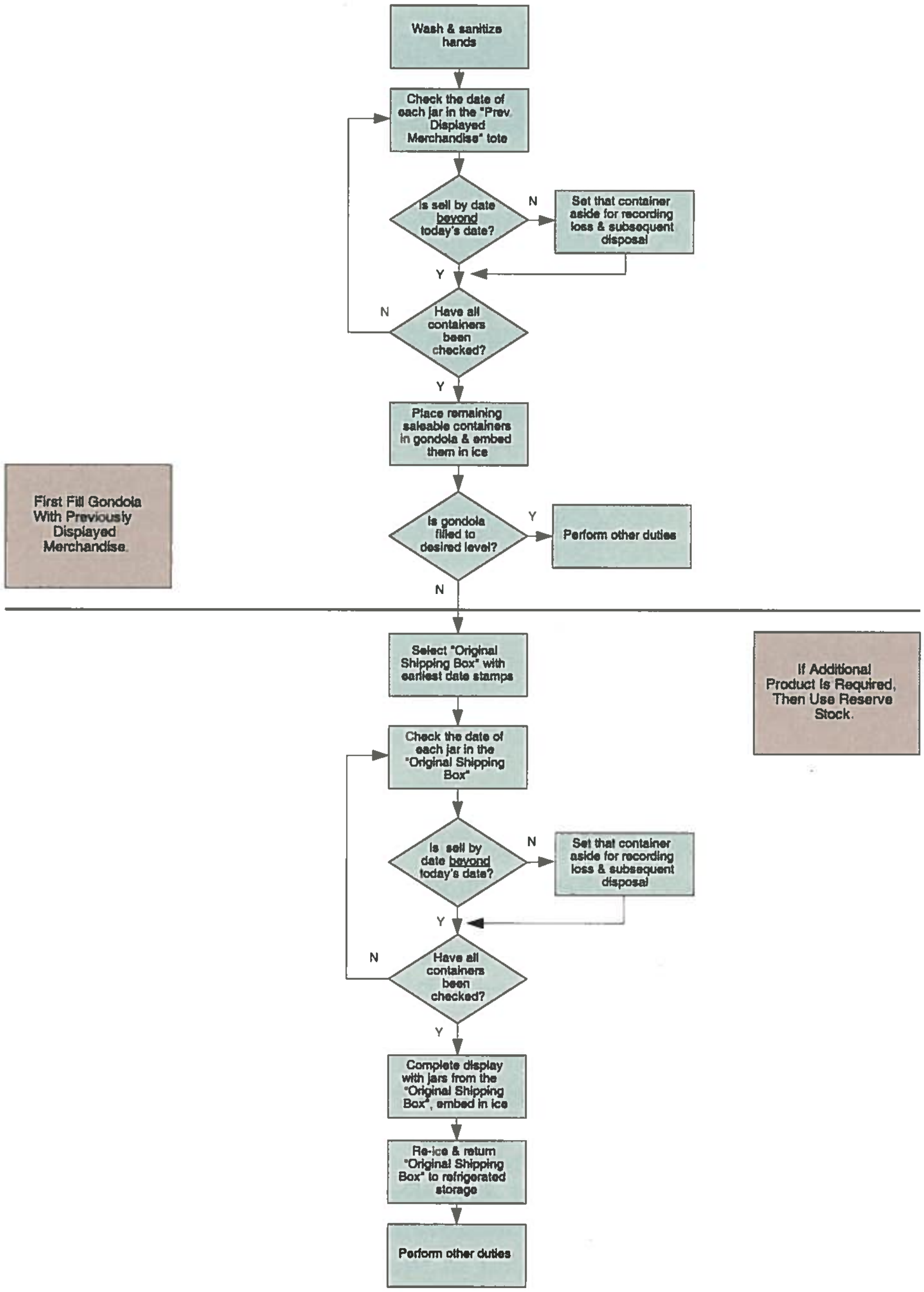


Fig. 5-32. Stepwise procedure for loading ice-only gondolas that ensures that products with the least amount of remaining shelf life exit first.

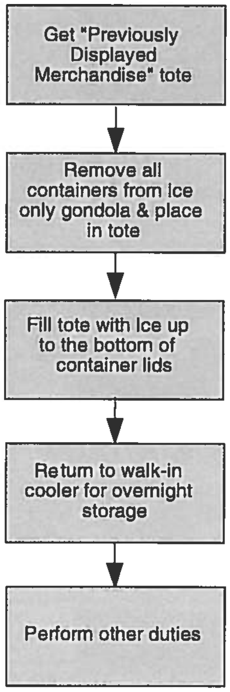


Fig. 5-33. Close-down routine for gondolas.

A Summary of the Standard Operating Procedure for Containerized Products Displayed in Ice-only Cases

> **To facilitate this separation, grocers need an additional tote in which to place the previously displayed containers. Once an item comes out of an Original Shipping Container and goes on display, it should always be returned to the Previously Displayed Merchandise tote. This will help the employee position those items with less shelf life so they can be sold first.**

When containerized merchandise is displayed in ice-only equipment, two elements of the preventive strategy are important: maintaining cold product temperatures and properly rotating inventory. This Standard Operating Procedure has specified the use of "Original Shipping Boxes" and a "Previously Displayed Merchandise" tote. The totes facilitate continual, virtually optimal temperature control during storage. When totes are used, ready-to-eat products like picked crabmeat and shucked shellfish are out of direct contact with ice *only* when containers are being placed in the display gondola or being removed from it at day's end.

Totes also enable previously displayed but unsold merchandise to be kept separate from that held in storage since receipt. Importantly, products should move from "Original Shipping Boxes" to display, and if unsold, to the "Previously Displayed Merchandise" tote. This gives the morning employee clear-cut information about which products should be redisplayed first. Such distinction is important because of the expected temperature differences between inventory held in refrigerated storage and merchandise displayed in ice only gondolas.

An omission uncovered in virtually all audits was failure to remove products displayed in ice-only equipment and return them to refrigerated storage at the close of business. While a tote does not ensure that this step will be completed, the senior employee who arrives and finds an empty tote and unsold items still on display has unequivocal information about noncompliance with the stated SOP.

The one element of the SOP in which totes have no role is ensuring full contact with container bottom and sides. Even slight airspaces between container and ice can interfere with heat transfer. Therefore, about every four hours ice should be redistributed around each container and additional ice added to the display if necessary.

Figure 5-34 (page 106) superimposes the SOP for containerized merchandise on the daily time line. Just as with the SOP for bulk-packed inventory, the morning employee performs the make-ready routines. Only two routine steps exist for the afternoon employee. The first of these is to redistribute ice around displayed containers and add more ice — probably around 2 p.m. or 3 p.m. Second, at day's end, remove all unsold containers, place them in the "Previously Displayed Merchandise" tote, re-ice them, and return the tote to refrigerated storage. Depending upon sales velocity, the afternoon employee may occasionally need to restock the gondola. Since the "Previously Displayed Merchandise" tote is *empty* after the morning stocking procedure, the only decision rule is to use merchandise with the earliest date stamps first.

Summary

Traditionally, product display has been considered a static function. We now know that this phase of the retail inventory cycle is anything but static, with numerous, repetitive steps required to set up the case in the morning, make selections for customers throughout the day, and close the department at day's end. To minimize both avoidable shrink and the opportunities for otherwise wholesome products to become unsafe, each goal of the preventive strategy must be met from the time that the first employee arrives until the last one is "off the clock." One element of the preventive strategy introduced in Chapter 3—periodic cleaning and sanitizing all food contact surfaces—cuts across various functions such as display and is addressed in Chapter 8. By way of a review, the three goals of the preventive strategy that can be addressed during the display function are:

- to minimize accidental contact opportunities among microbiologically dissimilar mix of seafood products customarily offered through full-service operations as well as between products and insanitary food contact surfaces,
- to maintain optimally cold product temperatures by (a) minimzing the elapsed time between morning roll out and stocking the case, and (b) by embedding pans and jars in ice and
- to position inventory with the least amount of remaining shelf so that it can be sold first.

Retail management must ensure that each goal is continually met across the variety of tasks required to complete the display function. This is a

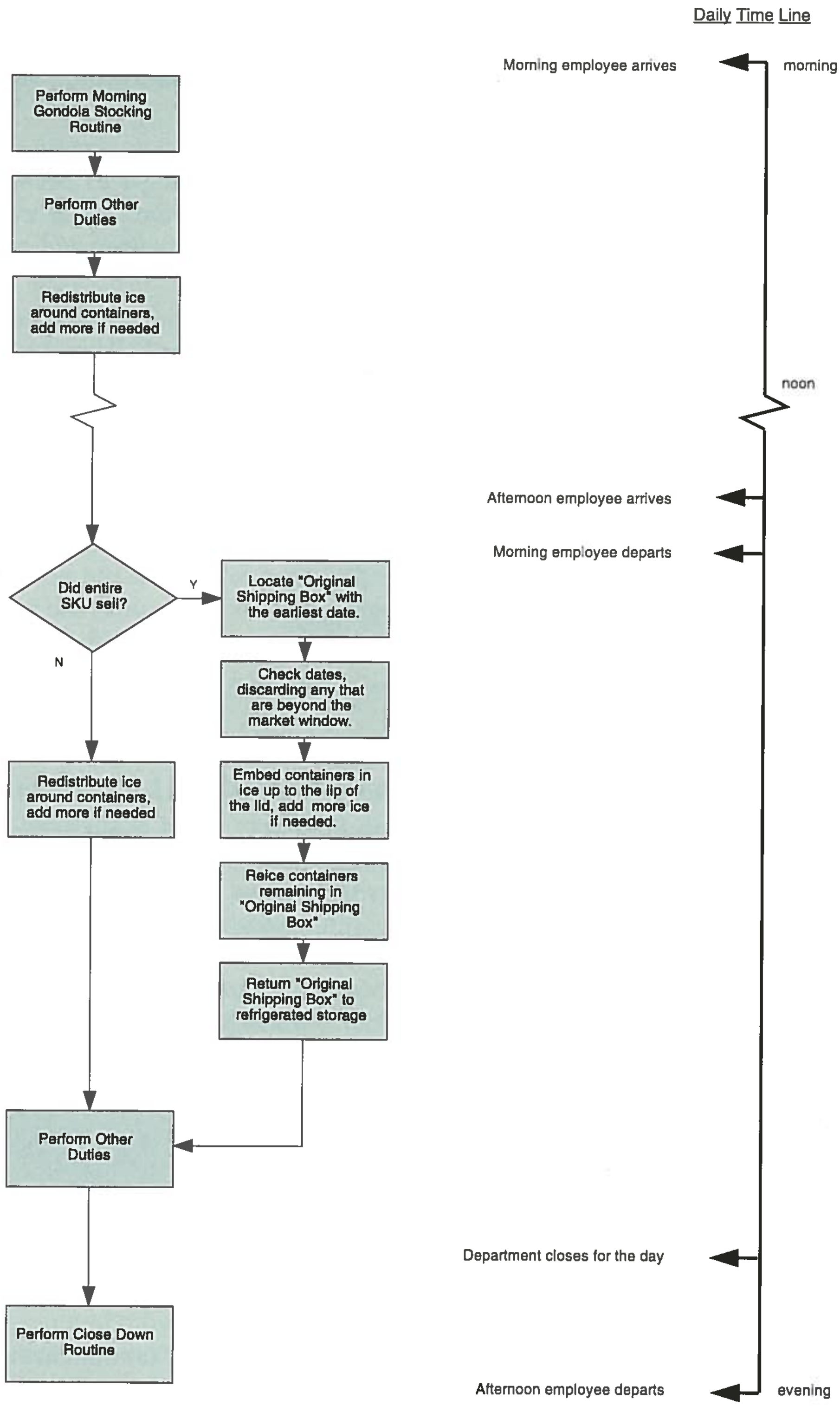


Fig. 5-34. The standard operating procedure for containerized merchandise displayed in ice-only equipment superimposed on the daily time line for departmental operations.

daunting challenge for several reasons. First, a contamination mistake — which may take no more than a few seconds to make—can create permanent, lagged effects. For raw products, the result is quite predictable: reduced time to sell perishable inventory that leads to increased avoidable shrink. With ready-to-eat products the same mistake increases the *probability* of compromising product safety. While a food-borne illness can be nothing more than a minor inconvenience, it can also create a major liability issue for the grocer. This type of error is virtually impossible to eliminate through supervisory oversight because the supervisor would have to observe a mistake in progress. If the error is not observed, no responsibility can be assigned because the effect manifests itself later. Second, all products — each dissimilar from all others with respect to remaining shelf life—must be placed in the case, selected throughout the day, and removed at the end of business. Third, these tasks must be completed by employees with a wide range of skill levels.

This chapter presented a comprehensive review of quality and safety concerns surrounding the varied tasks required to complete the display function. Three consistent practices were observed in the audits: (a) a washing/rinsing step completed prior to putting merchandise in the display case, (b) stocking dissimilar inventory items as a single task (without a glove change or hand wash between SKUs), and (c) upon closedown, failing to remove prepackaged products merchandised in ice only equipment. Most of the chapter outlined how best to achieve each preventive strategy goal with a set of simple procedures. These Standard Operating Procedures are the result of objective performance testing that, to the extent possible, mimicked the circumstances encountered in most retail operations.

Two prime elements are embodied in both SOPs. The first is fitting the task to the skill level of the person expected to complete it. Thus, most decisions and "back room" type work are the responsibility of the more senior staff who typically ready the department. Following this idea through the work day, the close down procedures are a series of discrete tasks, with no decisions required. The close down procedures are as streamlined as possible because most retail departments strive to remain open until the last minute, then rapidly close down.

The second common element between both SOPs is the use of containers for bulk packed inventory and specially marked totes for containerized merchandise. With respect to the full-service component of the department, pans are recommended to facilitate rapid removal of inventory from the case in the evening, and clearly establish which items were displayed the previous day. The use of display pans also enables items with the least amount of remaining shelf life (the previously displayed merchandise) to be positioned so they exit first. Additionally, pans facilitate maintenance of optimally cold product temperatures by taking full advantage of cold air that pools in airspaces below the bed ice. This is an important concern because generally an item that does not sell by the close of business will have to be held (stored overnight, and redisplayed the following day) for an additional 18 to 21 hours before the maximum traffic period is reached, usually 4 p.m. through 7 p.m. the following day.

If display pans are used for 100 percent of the displayed inventory, off odors are effectively and efficiently controlled. Traditional stocking procedures allow drip to collect in the catchment basin. This area, about eighteen inches below the ice rack, is typically warmed by the compressor. Spoilage bacteria in the drip combine with a warm environment to create significant odor problems despite an otherwise clean and sanitary operation. Conversely, when pans and inserts are used only melted bed ice flows to the catchment basin. Furthermore, each pan and insert are cleaned and sanitized daily. A substantial labor savings is realized when pans are used because the time interval between disassembling the case and cleaning and sanitizing it can be dramatically extended. However, If only certain items are containerized, the department still realizes all of the preventive strategy goals, but case breakdown will still have to occur with the same frequency as before.

For prepackaged inventory, containers (totes) serve two important purposes. First, prepackaged items such as shucked molluscan shellfish and picked crabmeat stored in totes can be surrounded with ice during storage. This approach maintains optimal temperature control during storage and minimizes heat gain during morning "roll-out" which maximizes remaining shelf life. Second, holding prepackaged items in specially marked containers distinguishes items held in refrigerated storage since receipt from previously displayed merchandise. Such a distinction is important because significant differences exist between product temperatures during refrigerated storage and display in ice-only equipment. Therefore, previously displayed items must be the first items stocked because there is less remaining shelf life among this class of product than items held under optimal storage conditions—even if the packages in question were delivered the same day and have the same sell by date. Finally, the specially marked totes reinforce the need to remove all unsold merchandise displayed in ice-only equipment at day's end and return it to refrigerated storage.

In an environment where an inadvertent mistake can permanently reduce shelf life or compromise product safety, the only workable solution is to adopt a specified set of tasks tested against the parameters of effectiveness, efficiency, and simplicity. Where possible, this chapter has attempted to quantify the performance expected when slight, seemingly trivial, changes are made to the SOP. Using stocking procedures for bulk packed products as a case in point, minor deviations from the SOP generally increased average product temperatures thus accelerating the consumption of remaining shelf life. Given the 18- to 21-hour holding period required before most products sell the following day, deviations from the SOP render an item unsaleable by the next morning or saleable for only a few hours the following day. Conversely, that same item displayed according to specification would remain saleable for the entire subsequent day. Therefore, altering the SOPs presented here without careful evaluation of the effects is **not recommended** because increased avoidable costs are the unintended net effect of minor changes.

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Chapter 6

Mixing, Packaging and Holding Refrigerated, Ready-to-eat Seafood Salads

OVERVIEW

Nationwide, retail executives ranked ready-to-eat foods third in importance from a list of features they intend to use to meet increased competition from the food service sector.[1] Among the ready-to-eat items prepared on-site in many full-service seafood departments are refrigerated, seafood salads made from commercially available, pasteurized ingredients.

Only two ingredients are required: a prepared base and imitation crabmeat. Fabricating such items is simple. Employees combine "X" containers of salad base to "Y" packages of imitation crabmeat and stir to mix ingredients. Properly fabricating and holding a mixture made from pasteurized ingredients should provide the grocer with a relatively long shelf life. Besides ultimate convenience for customers and a product with a long shelf life, seafood salads generate a relatively high gross margin with a moderate unit price — a welcome addition to most full-service seafood departments.

However, safety and quality risks are inherent in fabricating and holding cooked, refrigerated, ready-to-eat items. Spoilage is a constant concern with all perishable inventory, but the overriding issue with cooked, ready-to-eat foods is ensuring product safety. Because seafood salads are prepared from precooked, pasteurized ingredients then sold and consumed chilled, no final cook step can undo or negate the effects of cross-contamination, time/temperature abuse, or both violations of the preventive strategy.

Ready-to-eat foods have been a component of the retail product mix for years. Most seafood departments offer picked crabmeat, live and shucked molluscan shellfish, smoked fish, and other cooked products. In all but a few situations, these ready-to-eat products have been picked, smoked, or shucked by a processor, with the grocer assuming the traditional role of a pass through merchant. On the other hand, a ready-to-eat item fabricated on-site separates this type of product from the aforementioned ready-to-eat SKUs. The fabrication step, in effect, makes grocers food processors and many of the same process controls are required to ensure safety and quality. Once fabricated, this SKU can be merchandised in two primary ways: packed to order via a service case, or prepacked into consumer containers that can be inventoried in self-service ice-only gondolas or refrigerated coffin-style cases. Whatever the merchandising approach, seafood salads ultimately become another component of the product line that cycles between storage and display until sold or discarded. Therefore, the same controls required for the rest of the perishable retail seafood product line are also required once an item has been fabricated. The following sections enumerate the associated safety and quality risks of fabricating and holding ready-to-eat seafood salads, document where they occur during retail stewardship, and develop SOPs that can minimize these problems.

Safety and Quality Errors Observed During Fabrication and Holding of Refrigerated Ready-to-eat Seafood Salads

Managing the safety of a ready-to-eat item prepared on-site requires additional oversight because of the fabrication step. Much like on-site cooking, the fabrication step has to be completed correctly (i.e., no cross-contamination from microbiologicaly dissimilar products or insanitary food contact surfaces such as previously used gloves, pans, utensils, etc.) or safety can be permanently compromised. Compromises to the safety of seafood salads are permanent because, once, mixed, salads are not subjected to any thermal treatment that could kill pathogens introduced during fabrication. Some pathogens have low infective doses. This suggests that temperature control and proper handling procedures after mixing cannot ensure the safety of an improperly fabricated ready-to-eat product that is sold and served chilled.

Another concern that management must address is how long a product should be offered for sale because odor, one of the key quality indicators used to determine whether a product is saleable, is an unreliable sensory cue with many cooked, ready-to-eat products. Thus, other means must be used to establish the maximum expected sales window. This is a unique responsibility since prepackaged products arrive with date stamps applied by the processor. A date stamp may denote the last date by which the product can be used, or it may indicate when the product was packed.

The first section discusses errors that are unique to the procedure used to fabricate seafood salads. Following that is a discussion of errors common across most full-service seafood departments: (a) various cross-contamination venues observed once the mixed salad enters the retail inventory cycle (Figure 2-2, page 7); (b) observed holding periods for selling on-site prepared ready-to-eat products; (c) recorded holding temperatures in service and self-service environments; and (d) how a first in—first out (FIFO) rotation sequence was managed.

The prepackaged, pasteurized ingredients used to fabricate seafood salads are quite safe, and have a long shelf life. However, safety of the mixed salad depends upon (a) using proper steps to fabricate it, (b) establishing an appropriate sell-by date, and (c) ensuring low holding temperatures. To ensure consistent shelf life, grocers must also prevent the commingling of different batches when salads are displayed in the service case and packed to order.

Fabrication

Commercially prepared ingredients used to make seafood salads have a high margin of safety and a long shelf life because pathogens and spoilage organisms were killed during cooking and subsequent pasteurization. If, however, pathogens are inadvertently introduced during the fabrication step, product safety can be compromised. Likewise, remaining shelf life can be dramatically shortened if large numbers of spoilage organisms are accidentally introduced. Therefore, cross-contamination is the primary concern during fabrication, potentially affecting both food safety and shelf life.

Cross-contamination can be instantaneous but the damage (either a heightened risk of an unsafe product or spoilage) manifests itself later. Cross-contamination occurs when pathogens or spoilage bacteria are (a) directly transferred to ready-to-eat items from microbiologically dissimilar products or (b) indirectly transferred from insanitary hands, previously used gloves, pans, counter surfaces, or mixing utensils. Contamination occurs when spoilage or food poisoning organisms are transferred to ready-to-eat items from hands, pans, counter surfaces or mixing utensils. Such accidental transfers can occur anytime during routine operations. Some bacterial pathogens such as the vibrios or *Listeria monocytogenes* are normally found on raw products or environmental surfaces. Other bacterial pathogens like *Staphylococcus aureus*, salmonella and various Enterobacteriaceae including *E. coli*, result from human contact. Regardless of the source, such accidental transfers most often result from inadvertent employee actions. Thus, the precise stepwise procedure used by the employee to fabricate a ready-to-eat salad (or another precooked, ready-to-eat food) determines whether the finished product will remain as safe as the ingredients; and how long the mixture remains saleable.

Using a precise approach to fabricate seafood salads is key because the cross-contamination opportunities in full-service seafood departments are inordinantly high for four interrelated reasons. First, both raw and ready-to-eat products *simultaneously* move through the same functional steps of retail departments within a relatively small physical space. Second, the same person is normally responsible for a number of different tasks such as moving both raw and ready-to-eat items between storage and display, processing raw products, and of course fabricating ready-to-eat foods. Third, the same equipment (pans, spatulas, tongs, etc.) is often used across both raw and ready-to-eat product categories. Fourth, and most importantly, the standardized quality and safety audits revealed that employees appear to view their various duties within the department as one big job as opposed to a series of discrete, separate procedures, each of which must be correctly initiated. For instance, wearing disposable, single-use gloves is a common practice in full-service seafood departments. Yet, when new, disposable gloves are not donned prior to handling a different SKU or performing a different task, the glove itself becomes the primary pathway for indirectly transferring bacterial loads from microbiologically dissimilar items or insanitary food contact surfaces onto ready-to-eat products. The result is cross-contamination of the ready-to-eat food. A similar argument can be made about ensuring that fabrication begins with cleaned, sanitized pans and equipment. Thus, failure to change gloves at the beginning of a new procedure or forgetting to use cleaned and sanitized equipment can be a subtle, inadvertent, but effective way to compromise the safety of ready-to-eat products.

In stores where fabrication of seafood salads took place, auditors found

Auditors noted handling and holding errors that, when combined, created real food safety risks. Salads were mixed in bowls that were not first cleaned and sanitized. Because chilled salads are not heated prior to consumption, pathogenic bacteria or viruses accidentally transferred from microbiologically dissimilar products or insanitary food contact surfaces will remain viable.

that utensils and bowls were rinsed with tap water, but not detergent cleaned and sanitized. Mixing salad in an uncleaned, unsanitized pan that previously held raw products substantially increases the possibility of cross-contaminating the salad with both pathogenic and food spoilage microorganisms. Recall from the previous chapter that no seafood department that underwent a standardized quality and safety audit had duplicate sets of pans, so the pans were in constant use. Furthermore, no department had bowls, pans and equipment dedicated to either raw or ready-to-eat product lines, so the inadvertent crossover opportunities between raw and ready-to-eat equipment are real. In addition, employees responsible for mixing the ingredients began by wiping or rinsing their hands instead of detergent hand washing followed by a hand sanitizing step.

The fabrication procedure is straightforward. The employee selects the appropriate amount of each ingredient, adds these to a large mixing bowl, and blends the ingredients with a utensil. At that point the mixture can be lotted into consumer packages, placed in a display container, or returned to refrigerated storage until needed. These are steps anyone who has ever fabricated a seafood salad would specify. Importantly though, this sequence assumes that the employee begins with cleaned, sanitized hands and equipment, and dons new single-use gloves prior to the actual mixing routine. Unfortunately, when fabrication routines were observed during the audits, these key prerequisites were not always part of the procedure.

Holding Temperatures and Determining an Appropriate Shelf Life for Ready-to-eat Seafood Salads

Holding Temperatures

Core product temperatures recorded for salads packed in self-service containers and merchandised in ice-only gondolas were between 50° F and 60° F. At these temperatures, pathogens inadvertently transferred during the fabrication step could rapidly grow. Self service salads had 14 day marketing windows. Besides safety concerns, shelf life would be consumed way before the sell-by date elapsed.

Time/temperature abuse creates safety and quality problems for food retailers because temperature controls the generation time of a given bacterial population. As discussed in Chapter 2 on page 22, one hour of shelf life is lost for each hour the product remains at 32°F; yet for each hour the product remains at 50°F, four shelf life hours are consumed. Holding temperatures above 32°F have a significant impact on consumption of shelf life, particularly as holding times increase. For example, a product held at 32°F for a 12 hours would lose 12 shelf life hours while the same product held at 50°F for the same holding period would lose 48 hours of shelf life.

With respect to food safety considerations, some bacterial pathogens like the enterotoxigenic and enteropathogenic *E. colis* and the vibrios cause food-borne illness only at high infective doses. Likewise, the quantity of enterotoxin produced by growth of *Staphylococcus aureus* necessary to cause food borne illness requires a relatively high number of microorganisms. This suggests that time/temperature abuse is necessary to facilitate rapid growth of these organisms to threshold levels. Product temperatures between 41°F and 140°F provide conditions favorable for rapid growth of many bacterial pathogens.

Temperature history for bulk-packed inventory. Bulk packed seafood salads displayed in refrigerated service cases and embedded in ice were quite cold. In one outlet, the core temperature was 36°F at 7:50 a.m. and 34°F at 7:23 p.m., well below mandated maximum temperatures and cold enough to ensure a long shelf life.

Temperature history for prepackaged inventory held in ice-only cases. Significant opportunities for abusive temperatures over long time periods exist with ice-only display cases. Past research has documented that temperatures in ice-only cases just 2 inches above bed ice approximate ambient store conditions (Figure 5-9, page 71). In ice-only cases, product temperature is primarily controlled by that proportion of the container surface contacting ice. Recall from Figure 5-29 (page 99) that when pints of shucked oysters were placed on ice in an ice-only gondola, product temperature rose from 34°F to 46°F within 30 minutes and to 52°F within one hour. Ultimately, container temperature stabilized at roughly 60°F for the remaining five hours of the trial. Conversely, when packages were embedded in ice up to the bottom of the lid, temperatures increased to 40°F during the first hour on display and stablized at that temperature for the remainder of the trial.

Seafood salads packaged in one pound containers and placed *on ice* in self-service, ice-only gondolas registered core product temperatures between 50°F and 60°F. These product temperatures represent a significant safety concern to the retail firm for three reasons. First, salads were fabricated with equipment and hands that were not cleaned and sanitized. This omission substantially exaggerates the risk of cross-contaminating. Second, high product temperatures facilitate growth of certain pathogenic bacteria that may have been acidentally transferred to the product. Third, the time/temperature abuse of products merchandised in ice-only equipment lasted for several hours because in most stores such products typically remained in ice-only gondolas overnight.

Determining an Appropriate Shelf Life Interval

With raw seafood products, time/temperature abuse manifests itself through strong, objectionable odors generated by the growth of spoilage organisms. Although a definitive number of days a raw product may be held prior to sale is difficult to know, off-odors cue departmental employees that the item is no longer saleable. Unfortunately, most refrigerated, ready-to-eat products offer few such sensory cues since the vast majority of spoilage bacteria were killed via cooking. Because the spoilage characteristics of surimi-based seafood salads are fundamentally different from other seafood products, even fewer sensory cues exist that indicate this

Determination of an appropriate sell-by date represents a key safeguard against selling poor quality products. However, understanding what constitutes an appropriate shelf life interval for an on-site prepared, refrigerated, ready-to-eat item is a fundamental question for grocers. If sell-by dates are too long, shelf life will be consumed several days *before* the product is discarded. This means that grocers may inadvertently sell products that, at best, are of marginal quality, and, at worst, are deemed unsafe. On the other hand, setting a very conservative sell-by date will contribute to additional shrinkage, though the product is still saleable.

particular product should be discarded (pages 29-30). Thus, other means must be found to ensure that refrigerated, ready-to-eat foods on display provide the purchaser with a shelf life "use window." To establish appropriate time limits for use, sell-by dates are customarily used. The sell-by date reflects the total, remaining shelf life expected for that item.

Determination of an appropriate sell-by date represents a key safeguard against selling potentially unsafe or poor quality products. However, understanding what constitutes an appropriate shelf life interval for an on-site prepared, refrigerated ready-to-eat item remains a fundamental question for grocers. If sell-by dates are too long, shelf life will be consumed several days *before* the product is discarded. This means that grocers could sell products that, at best, are of marginal quality, and, at worst, could be deemed unsafe. On the other hand, setting a very conservative sell-by date may contribute to additional shrinkage.

Remaining shelf life is, at best, a moving target controlled by several considerations. These considerations include: (a) the remaining shelf life of the ingredients — if they are date stamped with a sell-by or use-by date, (b) recommendations for shelf life provided by public health authorities, and (c) holding temperature. The *maximum* expected shelf life of the mixture is generally determined by the ingredient with the *least* amount of remaining shelf life. Thus, if one ingredient has 14 days remaining on the sell-by date while another has 12 days remaining, the maximum shelf life available for the mixture would be 12 days. Most pasteurized ingredients have a long shelf life, and therefore the maximum expected shelf life is generally long for products manufactured from such ingredients. However, regulatory guidelines and holding temperature combine to reduce and standardize the expected shelf life of on-site prepared ready-to-eat foods like seafood salads.

Holding temperature of ready-to-eat items is now factored into the permissible amount of time available to sell the product.

According to public health authorities a refrigerated, ready-to-eat seafood salad can support the rapid and progressive growth of infectious or toxigenic microorganisms or the growth and toxin production of *Clostridium botulinum*. By definition, surimi-based seafood salads are potentially hazardous foods. Regulatory guidance for establishing use windows among potentially hazardous foods is becoming more restrictive. Several recent versions of the *Food Code* refer to the maximum shelf life of on-site prepared potentially hazardous food. The 1993 edition of the *Food Code* states that "a refrigerated, ready-to-eat potentially hazardous food prepared in a food establishment shall be discarded if not sold or served within 10 calendar days."[2] Holding temperature was not considered in establishing maximum use windows in the 1993 *Food Code*. However, in the 1997 *Food Code* the total time available to sell an on-site prepared item was shortened, and is now dependent upon holding temperature. Specifically, if products are held at or below 41°F, the product can be offered for sale for no more than seven days (including the day the salad is prepared).When products are held at or below 45° F, the product can be held for only four days.[3] Therefore, even if the remaining shelf life of each ingredient were 16 days, the 1997 *Food Code* indicates that the sell-by date should be no more than a maximum of seven days assuming it is held at or below 41°F. On the other hand, if the sell-by date on an ingredient is less that seven calendar days, then the expected shelf life would be governed by that ingredient.

During the 1993-1994 Standardized Quality and Safety audits, the sell-by dates of seafood salads prepackaged and displayed on ice in ice-only cases were 14 days beyond the date of observation.The recorded core temperatures of these products was 55°F. Referring back to Figure 3-3 (page 23), the expected shelf life for products held at 55°F is only about 60 hours — not 336 hours (14 days). Because package dates are used to separate saleable from non-saleable merchandise, the product would have been avialable for purchase almost two weeks beyond its actual shelf life!

Improper Stock Rotation Sequences

Rotating stock on a first in—first out basis is a necessity in all perishables programs. However, translating this conceptually simple idea into a procedure set that results in "selling the oldest merchandise first" is a challenging task. In stores offering seafood salads on a pack to order basis through the refrigerated service case, a set of conditions was observed that could derail a FIFO rotation plan. Likewise, in those stores that prepackage and merchandise salads in ice-only self-service gondolas, two situations were observed where proper rotational sequences were compromised.The common event linking all three situations was the inability to distinguish older from newer inventory.

Packing to Order through the Service Case

When an entire batch was displayed in the mixing bowl, neither a fabrication nor a sell-by date was marked on the bowl. This is an important omission because after two or three days on display, it is easy to forget when the batch was mixed. As sales are made, a bowl more empty than full gives customers the wrong message and violates many firms' merchandising policies. Without a SOP that specifically describes what to do with the remainder of a batch, the most expedient solution is to mix a new batch in with the remainder of an existing one.

Commingling batches could lead to sharply reduced shelf life because of "age" differences between the remainder of an existing batch on display and a newly mixed salad.The practical effect of commingling new and old batches would be to reduce the shelf life of the new batch by the age of the remaining batch. In other words, mixing a new batch on top of a batch held for six days makes the new batch six days old also. While no auditor observed batches being commingled, two conditions suggest that inadvertent commingling could occur. First, the absence of a fabrication date masks the accumulated elapsed time on display. Second, cooked items provide few sensory cues about changes in quality. Therefore, the opportunity to correct a poor image in the display case by preparing another batch in the same bowl seems tempting enough, and is likely to occur.

Merchandising Prepackaged Items through Ice-only Self Service Cases

In the previous example, the absence of a fabrication date for the batch and the inherent lack of sensory cues about remaining quality opened the door for inadvertent commingling between batches mixed at different times. However, when salads are packaged and offered through a self-service ice-only display case, the primary problem is determining whether packages of a given batch have been previously displayed or held in refrigerated storage since fabrication. This is important information because the holding temperatures during refrigerated storage and ice-only display differ by at least 8°F, thereby creating shelf life differences between components of the same batch.

Identical label information also interrupts proper positioning of previously displayed merchandise when containers were removed from ice-only cases and returned to refrigerated storage at day's end. A FIFO rotation plan requires that employees position previously displayed but unsold packages so they could sell first the following day. However, auditors could not distinguish between packages continuously held in refrigerated storage from those that were previously displayed because all packages from a given batch look the same, carry the same information on the label including the same sell-by date. Under this operational approach, items with the least amount of shelf life remaining (i.e., the previously displayed products) were treated identically as packages held under optimally cold storage conditions since fabrication. This is an important omission because after one day on display in an ice-only gondola, previously displayed merchandise has lost about twice the number of shelf life hours as the remainder of the batch held in refrigerated storage since fabrication.

Developing Standard Operating Procedures to Address the Quality and Safety Issues Uncovered in the Audits

Audits revealed that seafood salads were fabricated without proper safeguards to prevent cross-contamination. Subsequently, auditors found time/temperature abuse coupled with shelf life expectations that were unrealistic given the guidance found in the *Food Code*. Each of these findings is a concern, but added together, the safety and quality issues identified through the audits could cause problems for grocers. Importantly though, each of these concerns can be prevented with simple, straightforward solutions. The SOP should meet the following objectives:

- prevent cross-contamination by using only cleaned, sanitized equipment and hands during mixing, display and storage,

- maintain low product temperatures during storage and display,
- separate and clearly distinguish that portion of a batch held for future use (i.e., the reserve stock) from that going on display today. In a full-service environment where salads were packed to order, this would prevent inadvertent commingling of different batches. For containerized salads sold through ice-only equipment, using "Previously Displayed Merchandise" totes to hold previously displayed but unsold merchandise overnight in refrigerated storage would ensure that displayed but unsold items were the first packages redisplayed the following day(s).

To meet these objectives, a structured, sequenced set of procedures is offered. This procedure set not only delineates what to do, but when to do it. Table 6-1 (page 120) presents the quality and safety errors uncovered in the Standardized Quality and Safety audits and a recommended solution.

Preventing Contamination

With a seafood salad sold and served chilled, virtually no method exists to destroy pathogens introduced during retail stewardship. Thus, preventing cross-contamination is essential because some pathogens like listeria grow well at refrigerated temperatures. An imitation crab salad cross-contaminated with listeria poses a genuine safety risk since temperature control does not eliminate the possibility of food-borne illness with these types of bacteria.

Fabrication

In fabrication, the best assurance against inadvertently cross-contaminating ready-to-eat products is to begin the procedure with clean, sanitized equipment and hands (Figure 6-1, page 121). Just performing the actual fabrication steps without first completing the required prerequisites provides the retail firm with few assurances that the fabricated product is as safe as the unopened, prepackaged ingredients. The primary reasons are the inherent crossover among microbiologically dissimilar SKUs required by employees who work in the retail seafood department and the lack of equipment dedicated to either raw or ready-to-eat product lines.

The errors uncovered during the audits can be corrected with simple adjustments in Standard Operating Procedure (SOP). The mixing step is simplistic; however, cleaning and sanitizing hands, utensils, and bowls, and donning new disposable gloves must be prerequisite steps before ingredients are combined.

These prerequisites are key in preventing cross-contamination. Prior to use, food contact surfaces like pans, spoons, spatulas, counter tops, etc. should be detergent cleaned, rinsed, and dipped in (or sprayed with) a sanitizing solution. (A full discussion of cleaning and sanitizing is found in Chapter 8.) Because employees are the common link between raw and ready-to-eat items, ensuring that a separation occurs in activities that are common to these two product categories is essential if product safety is to be maintained. Thus, handwashing/sanitizing and a glove change is necessary when moving from one task to another. Note that gloves are essential in fabricating seafood salads since the *Food Code* specifically states

Table 6-1. Solving Current Safety and Quality Errors Encountered in Mixing and Holding Refrigerated, Ready-to-eat Seafood Salads

SOP Objective	Current Approach Revealed Through The Audits	Proposed Solution
Prevent Various Cross-contamination Venues	**Fabrication:** Hands not washed/sanitized prior to fabrication. Disposable gloves not used. Utensils and bowls not cleaned/ sanitized prior to mixing; yet, utensils and bowls were in constant use across raw and ready-to-eat lines.	**Fabrication:** Wash and sanitize hands. ***Food Code*** requires hand covering when handling ready-to-eat products so employees must don new disposable gloves before mixing. Utensils and pans must be cleaned/sanitized prior to use, or selected from standard locations that ensure this equipment was previously cleaned/sanitized.
	Close Down and Overnight Storage of Bulk Packed Merchandise: Several sheets of cling wrap were placed over the mixing/ display bowl. Bowl then placed in cooler. Storage location randomly chosen, and film did not provide a water-tight barrier.	**Close Down and Overnight Storage of Bulk Packed Merchandise:** Use a display pan (Fig. 5-10). At day's end, attach lid, place in top most location of cooler. Lid prevents cross-contamination from condensate. Vertical location prevents cross contamination originating from raw products.
Establish a Correct Sales Interval and Ensure Proper Rotation of Inventory	**Bulk Packed Merchandise:** No sell-by date was marked on the bowl used to mix and display salad. The lack of a sell-by date on the container does not communicate elapsed time since mixing. This may enable an employee to mix a new batch on top of a remaining batch that would reduce the shelf life of the new batch to the remaining shelf life of the earlier batch.	**Bulk Packed Merchandise:** The maximum sales window is 7 days or the manufacturer's sell-by date on the ingredients, whichever occurs first. Once mixed, fill display pan sized for expected daily sales. Transfer remainder to cleaned, sanitized container. This becomes the "**Reserve Stock**" of the batch. Label the container with sell-by date, place in the tote, surrounded with ice, and return to cooler. Display pan can be refilled with "**Reserve Stock**" contents from the same batch.
	Prepackaged Items in Ice-only Gondolas: Sell-by dates on consumer packages were 14 days beyond the date of observation. Display can be comprised of previously unsold items, and packages held in storage since fabrication. Once on display, shelf life consumption rates are **different** than items held in storage. Previously displayed items must be separated from those held in storage.	**Prepackaged Items in Ice-only Gondolas:** The maximum sales window is the lesser of 7 days or the manufacturer's sell-by date. Upon packing, record sell-by date on labels. First use containers from the "**Previously Displayed Merchandise**" tote to build the display, then complete the display with items items from the "**Reserve Stock**" tote. Once a container is removed from "**Reserve Stock**," it should only be returned the "**Previously Displayed Merchandise"** tote at day's end.
Ensure Optimally Cold Product Temperatures	**Bulk Packed Merchandise:** During display, product was cold (34-36°F). A common approach should be used across the firm.	**Bulk Packed Merchandise:** When stocking, embed pan in ice up to the lip of the container.
	Prepackaged Items: Some containers held in storage were not surrounded with ice.	**Prepackaged Items:** Once the containers are filled, place them in a "**Reserve Stock"** tote, completely surround with ice, and return to cooler for storage.
	Displaying containers on ice does not provide for adequate chilling. This accelerates spoilage and threatens the safety of ready-to-eat foods.	Embed each container in ice. Periodically redistribute ice around container surfaces, and add more ice as needed.
	Leaving containers in the display case overnight initiates time/temperature abuse as the ice melts.	Place all containers in "**Previously Displayed Merchandise**" tote, surround with ice, and return to storage cooler.

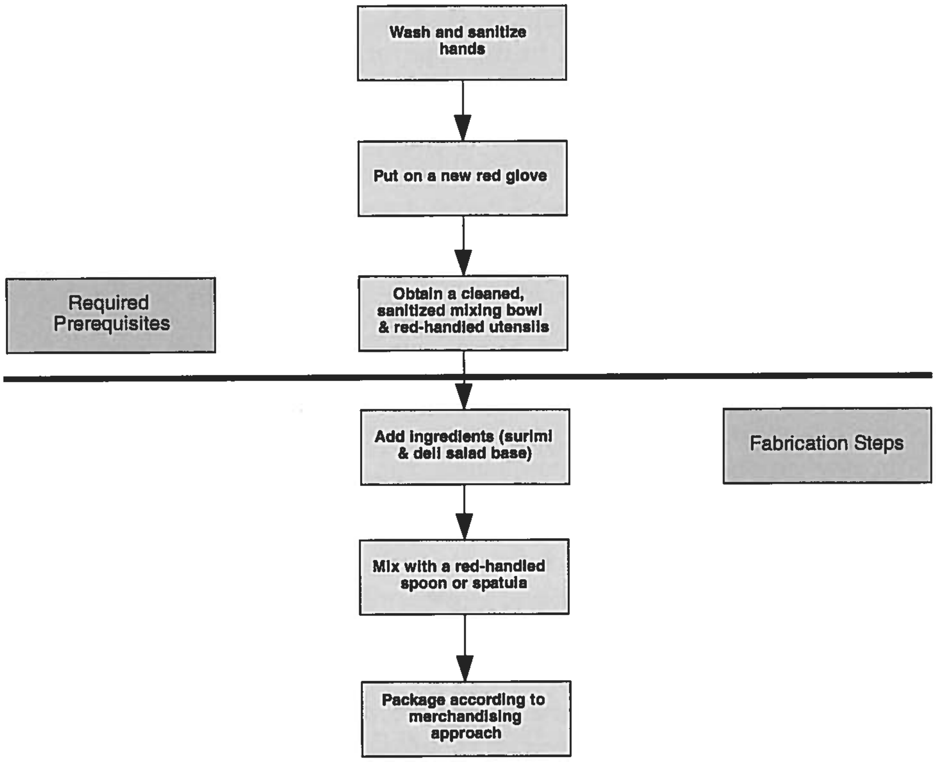

Fig. 6-1. A standard operating procedure for preparing seafood salads that includes both required prerequisites and actual fabrication steps.

that unprotected hands cannot contact any ready-to-eat products. Additionally, pans, tools, utensils and gloves should be dedicated for either raw or ready-to-eat items.

The best way to reinforce the idea of separation across raw and ready-to-eat product lines is to color-code utensils, pans and even disposable gloves. Color coding is important for two reasons. First it should reinforce the need to use different equipment and gloves when working with ready-to-eat or raw foods. This rule ("use white for raw products . . . use red for ready-to-eat items") will facilitate a glove change and use of different equipment when moving between raw and ready-to-eat products. Second, color coding is an obvious visual cue to the employee and management that facilitates simple, quick compliance checks and immediate corrective action if necessary.

Display

Seafood salads can become cross-contaminated anywhere in the retail inventory cycle. Bulk packed salad merchandised through the service case is vulnerable to a variety of cross-contamination opportunities. To prevent accidental cross-contamination in the service case, all ready-to-eat items should be segregated from raw inventory. Most firms have such a policy in place, and separation between raw and ready-to-eat was always maintained among the cooperating firms. The bigger cross-contamination concerns within the display step are activities required to load the display case, fill orders throughout the day, and unload the display case at day's end. Cross-contamination opportunities can be sharply reduced during necessary activities if salads are displayed in the type of deep steam table type pans illustrated in Figure 5-10 (page 78). The only modification for a salad would be to eliminate the perforated insert. When a lid is affixed, the pan contents are protected from drip or splash that can occur during loading/unloading activities.

Close Down and Overnight Storage

Seafood salads packed in steam table type containers can be treated just like all other inventory displayed in the case. Thus, the close down procedure presented in Figure 5-15 (page 83) should be used for seafood salads too. Once removed from the display case, seafood salads should be placed in the *top most* location of the storage cooler to prevent drip or splash from raw products cross contaminating the salad. The rigid top also prevents cross-contamination of salad from condensate that may form in the cooler.

Maintaining Cold Product Temperatures

Within the refrigerated temperature range, ice is the most effective chilling medium. However, its effectiveness is determined by how it is used. When containers are embedded in ice, most surface area contacts ice and cold product temperatures can be maintained. However, when a container is placed on ice, limited chilling occurs. This situation is exaggerated in ice-only display cases.

Containers displayed in ice-only gondolas must be completely embedded in ice. When embedded in ice, core product temperatures hover around 40°F. This holding temperature is important in determining a sell-by interval that is consistent with new regulatory guidance. The 1997 *Food Code* states that products held at or below 41°F can be held for seven days, but products held at or below 45°F can be displayed for only four days.

Keeping products cold in an unrefrigerated, self-service ice case can be done, but requires monitoring every three or four hours. When stocking ice-only cases, employees should embed containers in ice up to the bottom of the lid. Subsequent monitoring should ensure that ice continually contacts container surfaces. When ice melts away from container surfaces, even slightly, an insulating air pocket is established and heat transfer is much less effective. Therefore employees should periodically redistribute ice around packages about every three or four hours — adding more ice if necessary — so contact is maintained with the entire wall of each container (i.e., ice should contact the container up to the lid).

Ensuring Proper Inventory Rotation and Preventing Commingling of Different Batches

Fabricating under sanitary conditions prevents the introduction of pathogenic and spoilage bacteria, while maintaining cold holding temperature ensures that the maximum permissible shelf life is achieved. To market safe, fresh, long-lasting seafood salads, retail departments also need procedures that ensure proper rotational sequences. This procedure set must address all possible situations yet be simple to understand and implement since, at some point, all employees (even the least experienced) are responsible for ensuring proper rotational sequences.

The best insurance against improper rotation of prepackaged inventory or inadvertent commingling of batches is to separate and clearly identify that portion of a given batch being displayed from the remainder that is held as reserve stock in refrigerated storage for future sales. This separation is necessary for both merchandising options. The idea of reserve stock is straightforward. Except in those cases where an entire batch sells in a single day, all retailers maintain a reserve stock. This SOP simply requires that reserve stock be held in a specially marked container or tote, depending upon the merchandising option.

Procedures That Ensure Proper Rotation of Salads Sold Through Refrigerated Service Cases

For this merchandising option, two unique containers are used: one for displaying seafood salads in a service case and the other for holding reserve stock in refrigerated inventory. Ideally, the display container should be sized according to expected daily sales, and should be six inches deep. Once a batch is prepared, the quantity needed for the day can be transferred to the display pan, which is then embedded in bed ice of the display case. The remainder (the reserve stock) can be transferred to a cleaned, sanitized plastic container with a snap lid, marked with the sell-by date, placed in a tote, surrounded with ice, and held under refrigerated storage until needed For items displayed in the refrigerated service case, the sell-by date should be the lesser of seven days or the manufacturer's sell-by date listed on the ingredients.

Batch control is another important element of the seafood salad SOP. Departments that display salads in service cases and pack to order need three containers: a mixing bowl, a display container, and a sealable container to hold that portion of the batch not being displayed (the reserve stock). Salad from the reserve stock container can be added to displayed but unsold merchandise so long as it is from the same batch.

Until the sell-by date is reached, employees can add reserve stock to previously displayed product from the same batch. This is permissible because data collected during the audits indicated no significant temperature difference between those items embedded in ice of a refrigerated case and other items surrounded with ice and held in refrigerated storage. Since holding temperatures were equal, both the reserve stock and the previously displayed merchandise have the same amount of remaining shelf life at any point in time. With bulk packed items, the sell-by date of the batch is the controlling unit in the stock rotation scheme.

When the remaining batch (both previously displayed merchandise and reserve stock) is insufficient to meet expected daily sales the entire batch should be: (a) packed in end-user containers and placed in a self-service case, (b) used for samples, or (c) discarded as the quantity warrants.

Batch control differs when products are packed in consumer packages and displayed in ice only equipment. Experimentation has shown that significant temperature differences exist between reserve stock held in refrigerated storage and containers embedded in ice. Yet, use-by labeling is the same for all containers packed from a given batch. To ensure that packages with less remaining shelf life are positioned to sell first, containers from this tote should be restocked first the following day.

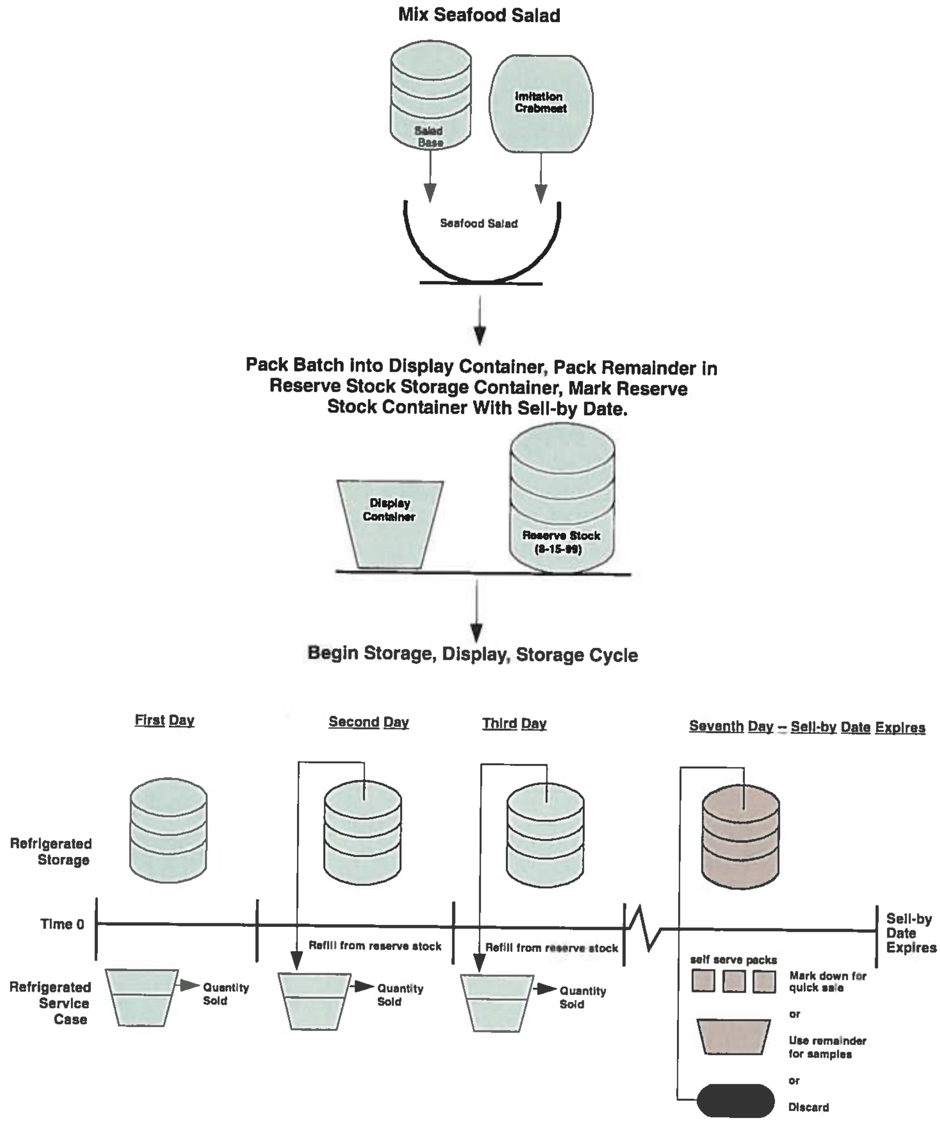

Fig. 6-2. A sequential stock rotation system for bulk packed salads displayed in a refrigerated service case ensured by tracking the sell-by date.

This approach prevents commingling of batches when refilling a display container, ensures maximum shelf life of each batch, and guarantees a first-made/first-out rotation system.

Figure 6-2 illustrates this concept. The assumption is made that average daily sales just correspond with the interval between mixing and the seventh day. Therefore, as the volume of the display pan drops, replenishment is made from the reserve stock packed when the batch was originally mixed. On the sell-by date, the remainder of that batch (both reserve stock and previously displayed merchandise) is either marked down for immediate sale, used as samples or discarded as corporate policy dictates.

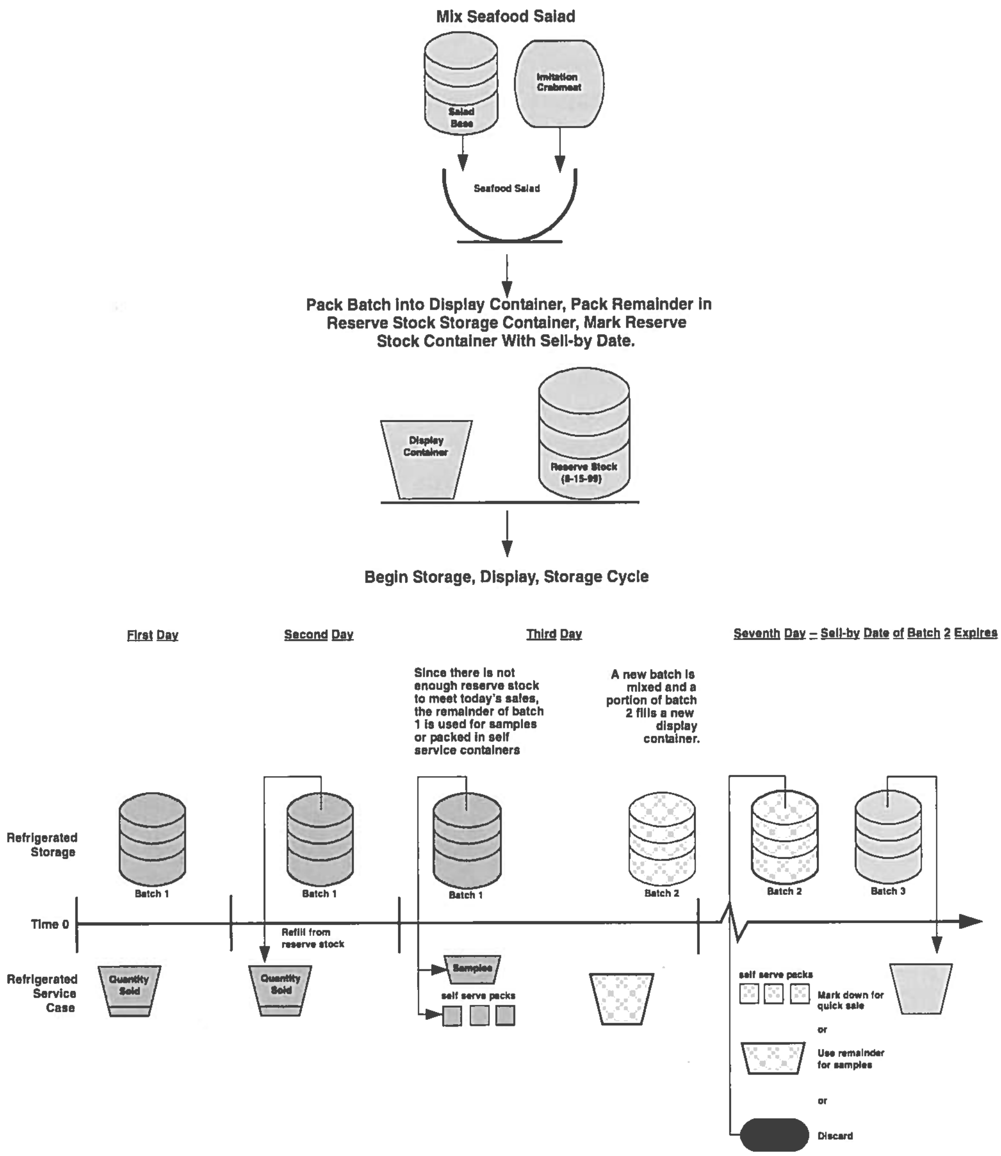

Fig. 6-3. A sequential stock rotation system that prevents commingling batches of bulk packed seafood salads displayed in a refrigerated service case ensured by tracking the sell-by date.

Conversely, Figure 6-3 depicts a more rapid daily sales volume so that one batch is *nearly* used up by the third day since fabrication. On the morning of the third day, departmental employees find that there is not enough of Batch 1 to cover anticipated daily sales. At that point the remainder of Batch 1 is either packed into self-service containers or used as samples. Another batch is mixed, but a *new* display pan is filled with Batch 2. On the pull date for batch 2, any remainder can be managed as in the previous example.

Procedures That Ensure Proper Rotation of Salads Displayed in Ice-only Gondolas

Product temperatures can be maintained at 41°F in ice-only gondolas if: (a) products are embedded in ice up to the lid, and if (b) ice in the gondola is periodically redistributed to maintain contact with container surfaces, and if (c) new ice is added as needed — generally once in the early afternoon. At this temperature, products can be held for seven days as specified in the 1997 *Food Code*. An important reminder, however, is that even with proper placement in the ice-only case, a temperature difference of about 8°F exists between items held in refrigerated storage (the reserve stock) and items offered for display. This difference needs to be considered in stock rotation plans if items with the least remaining shelf life (i.e., previously displayed merchandise) are to be sold first. Because of this difference in holding temperature, two sets of rotation criteria exist:

- ensure that the first batch made is the first batch sold and
- ensure that previously displayed but unsold items are the first packages to be redisplayed on subsequent days.

Distinguishing between batches is relatively easy. With fabrication so simple, most departments would have to contend with multiple batches only when the sell-by date of an existing batch is eminent. Once fabricated, the entire batch should be packed in end-user containers, weighed and labeled. Those packages that are not needed for the day's sales should be placed in the "Reserve Stock" tote, surrounded with ice, and returned to refrigerated storage.

Since managing the previously displayed stock adds additional complexity to the plan, a key element of an error proofed, simple rotation plan is to limit the number of packages to be displayed to the number expected to sell in a single day. Over time, this approach will minimize the number of packages that must be managed as previously displayed but unsold merchandise.

Each evening, all unsold items should be removed from ice-only displays, loaded in a tote marked "Previously Displayed Merchandise," well iced, and placed in the cooler for overnight storage. The next morning, items in the "Previously Displayed Merchandise" tote should be stocked first in the ice-only case and positioned to sell first. Any additional packages needed to complete the display should come from the "Reserve Stock" tote and should be placed near the back of the display (Figure 5-31, page 102). As discussed in the previous chapter, once an item is removed from the "Reserve Stock" tote and placed on display, it should only be returned to the "Previously Displayed Merchandise" tote. This approach ensures that items in a given batch with the least amount of remaining shelf life (containers held at higher holding temperatures for 12 to 14 hours each day) are positioned to sell first on subsequent days. This approach is illustrated in Figure 6-4.

At the commencement of business on the day that the sell-by date expires, previously displayed but unsold items should be marked

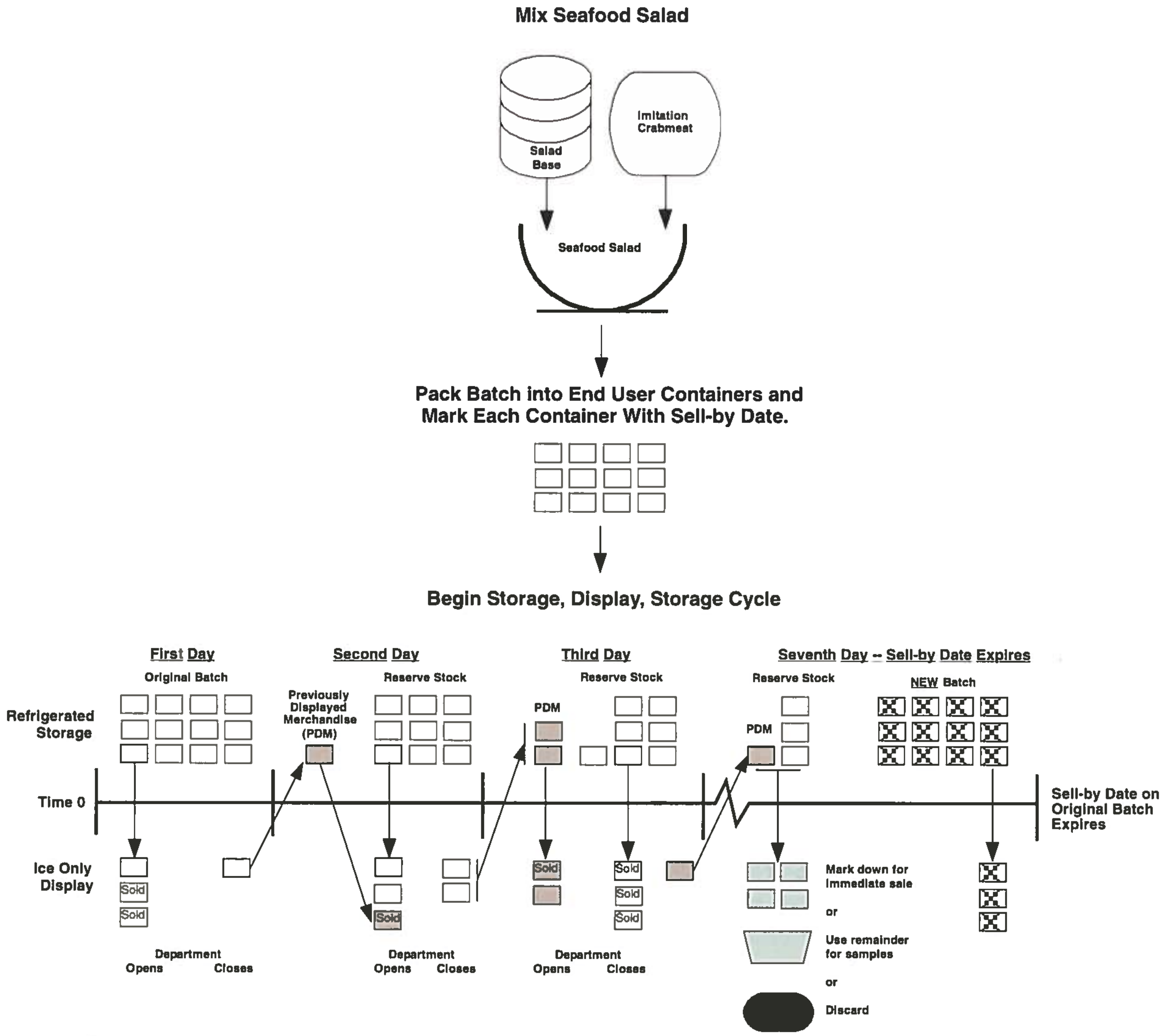

Fig. 6-4. A sequential stock rotation system for prepackaged items merchandised in an ice-only case that ensures both a First-made—First-out and a Previously Displayed—First-out approach using sell-by dates and specially labeled totes.

down for immediate sale, used as samples, or discarded (Figure 6-4). Importantly, all remaining components of the batch — both previously displayed items and the reserve stock — are treated similarly. One optional twist might be to sample the reserve stock or mark it down for immediate sale, but discard previously displayed merchandise. While the disposition of this merchandise depends upon the firm's policy, items marked down that do not sell by the end of the sell-by date should be discarded.

When salads are prepackaged and displayed in ice-only self service cases, the use of specially marked totes to hold both "Reserve Stock" and "Previously Displayed Merchandise" ensures that all employees can distinguish between both classes within the same batch. This distinction helps ensure that previously displayed items are redisplayed first on subsequent days.

A Graphic Review of Fabrication, Packaging and Holding Steps

Superficially, the fabrication and holding of ready-to-eat seafood salads seems like a simple, basic exercise. However, when auditors thoroughly investigated the process, it became clear that several key steps must be properly executed in the right sequence to meet quality and safety objectives. Yet, the audits indicate that employees often undertake a function without the benefit of structured methods.

One way to demonstrate the steps, decisions, and linkages among different components of a particular function is with a process flow chart. These charts take a general function such a preparing, packaging, and holding ready-to-eat salads, and break it into the most basic steps necessary. This adds clarity and structure to the function, and teaches the correct way to complete a task. It also properly defines the procedure set necessary to address all possible outcomes, thereby providing a comprehensive management structure. Such charting may also help with compliance checks by retail management. Finally, the thinking required to produce such a process chart indicates to regulatory authorities that management understands the steps and sequences necessary to ensure quality and safety on a day-in/day-out basis.

Each flow diagram presents the entire slate of activities and decisions required to manufacture, package and properly rotate ready-to-eat seafood salads until the sell-by date expires. Importantly, most of each diagram addresses the various situations that impact upon stock rotation. Of the three control points necessary to market safe, fresh, long-lasting seafood salads, ensuring proper rotation occupies the most space in the chart because it may traverse several days and must be implemented by numerous workers until the sell-by date elapses. Also, varied conditions signal that a batch be pulled and either used for samples, marked down for same day sale, or discarded.

In Figures 6-5 and 6-6, diamonds represent decisions that must be made, and the lines direct the flow of activities. Rectangles indicate specific steps or procedures that must be undertaken. To conserve space and to focus on the specific steps required for this SOP, the contents of each rectangle are distilled to the simplest steps required. For example, Figure 6-5 specifies that the employee spoon salad from the "Reserve Stock" container into the display pan. Once the employee is finished with the red-handled spoon, this utensil shuld be placed in a sink, then cleaned, sanitized and stored in a standard location, but these steps are omitted from the diagram. The customer service routine has also been omitted in Figure 6-5 to conserve space, but recall that the customer service routine was consistently correct among cooperating stores (pages 63-64). The "Perform other duties" rectangles in both figures indicate that, for the moment, the seafood salad SOP is complete and the employee can address other necessary tasks in the department. At some point he returns to the seafood salad SOP, either to wait on a customer, when the display sells out or when the sales day ends.

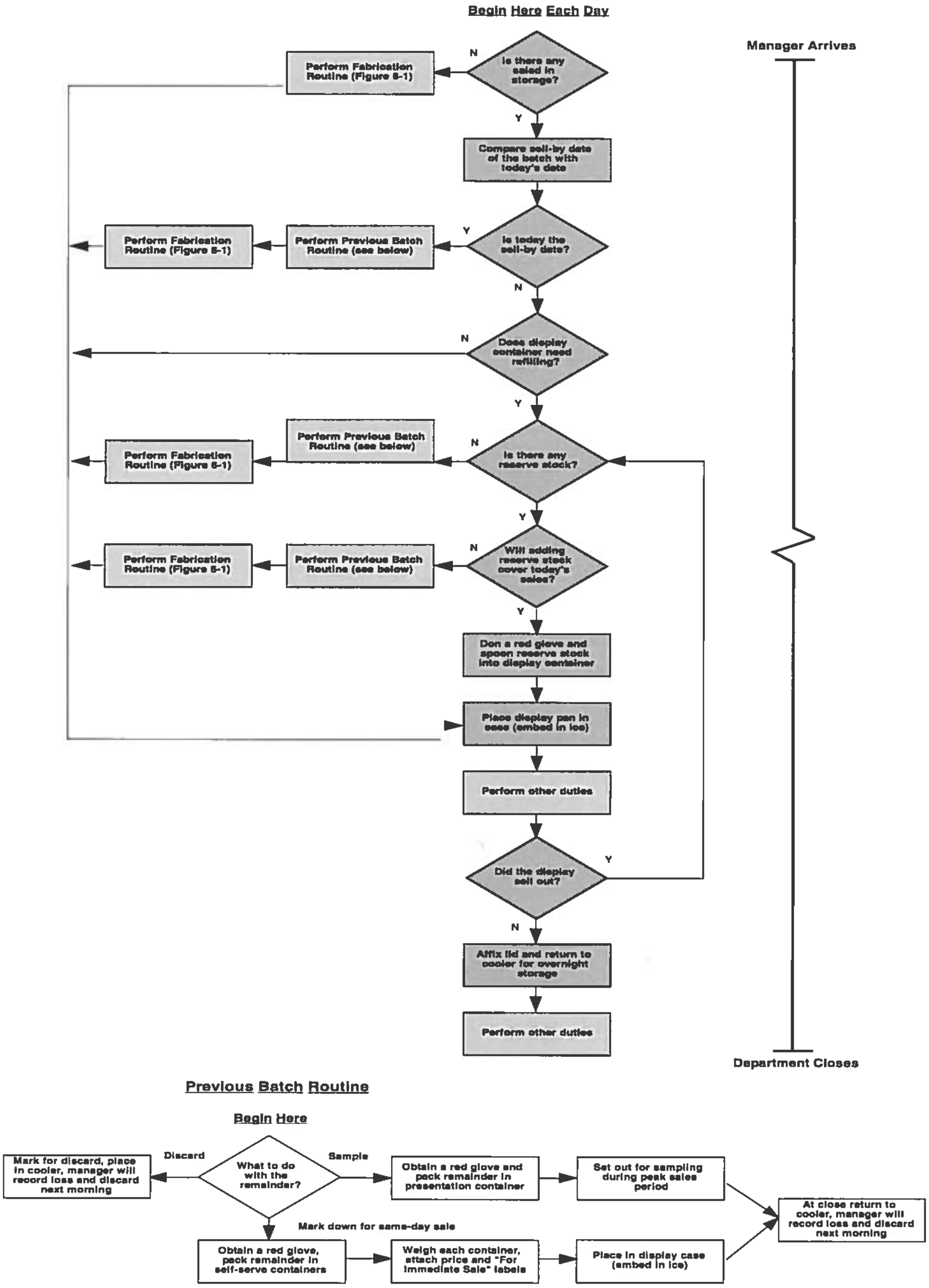

Fig. 6-5. Fabrication and stock rotation plan for chilled, ready-to-eat seafood salads packed to order and sold through refrigerated, full service cases.

Figure 6-5 presents the stepwise procedures for fabricating, packaging and rotating inventory when it is packed to order through a full-service case. When products are displayed in a refrigerated service case, employees continue to display/redisplay and replenish displays with reserve stock from the same batch until (a) less than a day's sales are covered with a given batch or (b) the sell-by date of the batch expires. Either situation signals the need for a new batch; but regardless of the reason, old and new batches are never mixed. Instead, the older one is packed in self-service

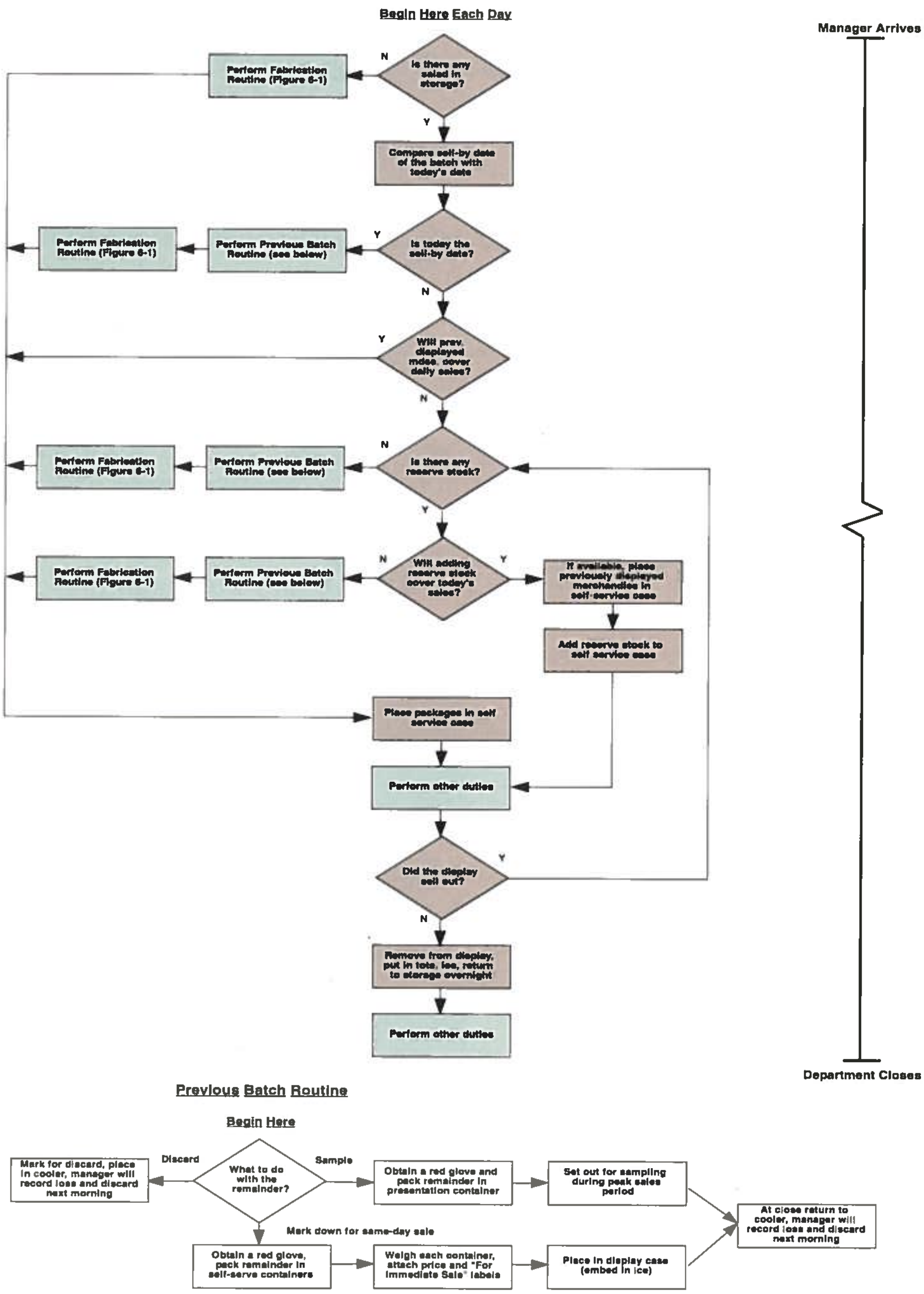

Fig. 6-6. Fabrication, packaging and stock rotation plan for prepackaged seafood salads sold through ice-only self-service cases.

containers and marked down for same day sale, used for samples, or discarded according to store policy.

Figure 6-6 highlights a slightly different set of steps when the merchandising option is to prepackage seafood salads and display them in an ice-only self-service case. Employees then redisplay the items until a batch is sold out or the previously displayed components of a batch reach their permissible number of display days. At either point, a new batch is prepared and the process begins again.

Although each figure defines a unique set of steps, both specify precisely how to implement the reserve stock idea and use it effectively either to prevent commingling of different batches or ensure that products with the least amount of permissible shelf life are positioned to sell first on subsequent days.

Conclusions

Once pasteurized, unopened ingredients are fabricated on-site, seafood salads can have a shelf life of seven days. The fabrication procedure should begin with cleaned, sanitized dedicated equipment to prevent cross-contamination of ready-to-eat ingredients and foods. To deter inadvertent crossover between raw and ready-to-eat product lines, the use of color-coded equipment and gloves is suggested. Color-coded gloves, utensils and pans also facilitate management oversight of the function.

Proper temperature control is essential to maintain the maximum permissible shelf life available from potentially hazardous foods. Once fabricated, reserve stock should be placed in a tote and well iced to ensure an optimally cold product temperature. In refrigerated service cases, display pans should be at least 6 inches deep so that when embedded in bed ice maximum container surface area contacts ice. This facilitates heat transfer. Packages displayed in self-service, ice-only gondolas must be embedded in ice up to the lid to achieve acceptable cold temperatures that, following regulatory guidance, allows a permissible shelf life of seven days. Additionally, employees must periodically redistribute existing ice so that it contacts container surfaces and, when needed, add additional ice in the afternoon. If not properly positioned in ice and periodically checked, ready-to-eat items merchandised in ice-only equipment can rapidly gain heat and may pose a safety threat to the purchaser.

At the end of business each evening, items displayed in refrigerated service cases should be covered with a rigid lid, removed from the display case, and returned to the storage cooler. Prepackaged items displayed in ice-only equipment should be removed each evening, placed in a specially marked tote to indicate previously displayed merchandise, liberally iced, and returned to refrigerated storage.

First-in—first-out rotational sequences are essential to maintain a fresh, long-lasting inventory that returns adequate gross margins while remaining competitively priced. When seafood salads are merchandised in refrigerated service cases, the reserve stock can be added to a display *so long as it is from the same batch*. Once the existing batch is insufficient to meet expected daily sales, the remainder (including reserve stock and previously displayed merchandise) should be used as samples, or repacked in self service containers. Either of these two options prevents commingling of different batches. At the close of business each day, items displayed in refrigerated service cases should be covered with a rigid lid, removed from the display case, and returned to the topmost location in the storage cooler.

Maintaining a FIFO rotation system when products are displayed in an ice-only self service case requires retail employees to use two totes: one marked "Reserve Stock" and the other marked "Previously Displayed Merchandise." Each day, the employee shuld begin creating the display of salads with packages from the previously displayed merchasndise tote, and, if needed, complete the display by adding packages from the reserve stock tote. When merchandising prepackaged items in unrefrigerated ice cases, retailers should stress that employees display no more than what is expected to sell in a given day. At the close of business, the employee shuld remove any packages from the ice-only gondola, place them in the "Previously Displayed Merchandise" tote, surround each container with ice and place the tote in the cooler.

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Chapter 7

Custom Cooking for Individual Customers

Overview

In many establishments, retailers provide custom cooking (steaming) services to patrons. Cooking to order provides a significant convenience to customers since they are presented with a ready-to-eat product. Many retail firms will, in all likelihood, expand such services in response to demand for more convenience in the product mix. Because consumers leave the store with a warm, ready-to-eat product cooked on-site, the primary concern is preventing retail negligence that could compromise product safety. To minimize food safety problems, management must understand (a) what food safety risks are inherent in the custom cooking process and (b) where in the process product safety may be compromised. Only then can a plan be drawn up that designs potential errors out of the custom cooking function.

Custom cooking is a production-oriented process. In other chapters, SOPs have been designed so that these types of activities are performed by the more experienced person in the department. Unfortunately, this fundamental design element is lost when building an SOP for custom cooking because this activity coincides with the peak sales window that generally lasts from about 4 p.m. until approximately 7 p.m. At that time of day, many departments are staffed by parttime employees whose primary role is to wait on customers and fill their orders. Nevertheless, this SOP must specify precisely how to accomplish a relatively complex task performed during a busy time at the seafood counter while preventing inadvertent actions that could compromise product safety. This SOP is also unique because it addresses a sequence of steps required once a customer opts for a steamed product. Unlike all other SOPs that address how best to meet the goals of the preventive strategy over several days of repetitive cycling between display and storage, this procedure focuses on a short time span; generally less than 30 minutes. These conditions, and the downside risk of "doing it wrong" make design of an SOP for custom cooking among the most challenging elements in retail quality and safety management.

Food Quality and Safety Errors Observed During Custom Cooking Operations

Typically, a quantity of raw or live product (shrimp, lobster, crawfish, crab, etc.) is selected, weighed, priced, and then steamed. Once an order is placed, customers normally continue with other shopping and return later to retrieve their purchases. Four distinct steps comprise the custom cooking process: (a) selecting and weighing raw or live products, (b) cooking,

(c) post-cook handling that may include seasoning prior to packaging, and (d) holding cooked product for subsequent pick-up by the customer.

Potentially, all steps beyond selecting the raw product can affect product safety. Cooking should be sufficient to kill both spoilage and pathogenic bacteria yet not be so severe (i.e., too long a time) that the product is overcooked since most customers would consider this a quality defect. Once the product is fully cooked, safety can be compromised by cross contaminating it with either raw items or insanitary food contact surfaces.

During the audits various cross-contamination events were observed: (a) repacking cooked shrimp in the same bags used to weigh the raw market form, (b) handling cooked product prior to cleaning, sanitizing, and covering hands, (c) using the same disposable glove(s) to handle raw and cooked products, (d) using insanitary utensils to mix cooked product with seasoning, and (e) allowing drip and splash from raw shrimp to contact cooked products. Any of these cross-contamination opportunities can instantaneously occur. Most often they result from an accidental or inadvertent action by an employee. No where is the opportunity to make these mistakes greater than with products custom cooked in the seafood department, primarily because the cross-contamination potential is high in these settings. This is to be expected when a mix of raw and cooked products exists within the same space.

Previous chapters have attempted to match specific tasks with employee skill levels. Most of the production-oriented functions are completed by the more senior employees. However, custom cooking coincides with peak sales periods. Therefore, most custom cooking will be completed by parttime employees.

While the custom cooking process itself is straightforward, each order must be separately selected, priced, steamed, perhaps seasoned, and packaged. This makes custom cooking a batch process. Therefore, handling multiple batches is common for the employee. For example, as a tray of cooked product is removed, another is placed in the steamer, then the employee returns to season and package the first batch of cooked product. Likewise, during the peak sales period, it is routine for the employee to initiate a cook cycle, fill other customers' raw seafood orders, then remove the cooked product, and proceed with seasoning and packaging steps. This type of crossover between raw and cooked products *dramatically* increases the cross-contamination potential.

Inadvertent cross-contamination of any ready-to-eat food boosts the probability of food-borne illness. For those pathogens with a high infective dose, maintenance of low temperatures after cooking can reduce the opportunity for food borne illness because microbial growth is slowed at low temperatures. On the other hand, low temperatures are not an effective control mechanism for pathogens with low infective dosages. In most custom cooking operations, once the batch is removed from the steamer cooked it remains within a temperature range that supports rapid growth of microorganisms until it is consumed (Figure 7-1). As illustrated, the elapsed time products remain in this 41°F to 140°F zone may be several hours. This occurs because cooked shrimp are allowed to cool on the counter at ambient room temperature and are then passed to customers

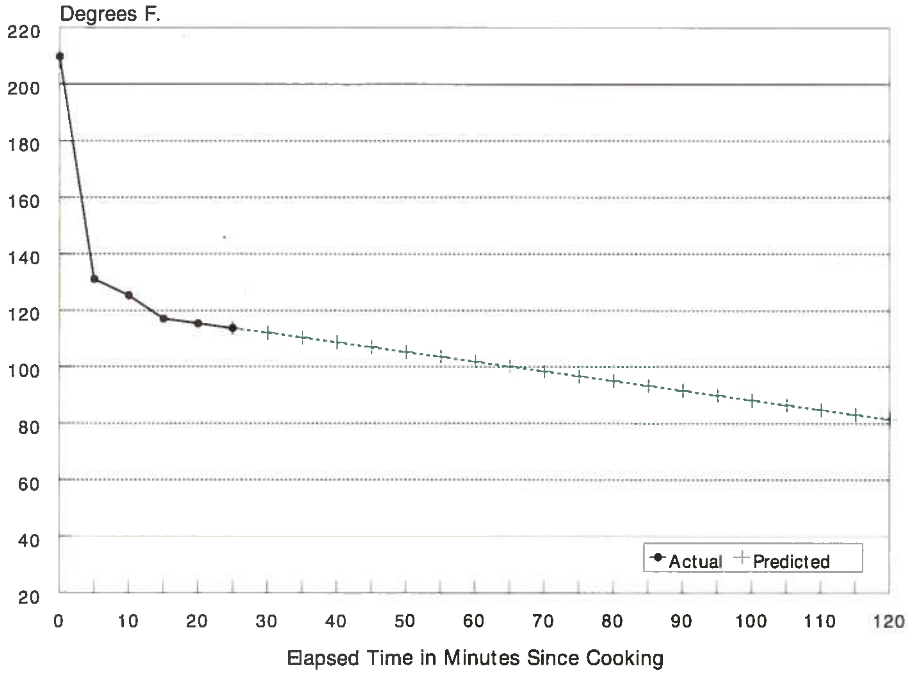

Fig. 7-1. Temperature changes in steamed shrimp when allowed to cool at ambient store conditions.

Proper cooking destroys pathogens found on raw products. However, once removed from the steamer, within five minutes products enter a temperature range that supports rapid growth of pathogenic and spoilage bacteria. Therefore, any post-cook cross-contamination could compromise the safety of this ready-to-eat food.

in a warm (or hot) state. The time and temperature range shown in Figure 7-1 is *optimal* for bacterial outgrowth. Therefore, should post-cook cross-contamination to occur, there is no way to control bacterial numbers. Further complicating the picture is the assumption that the cooked product will not be reheated prior to consumption. Thus, a busy day, multiple batches in progress, customer distractions, no procedure set to prevent cross-contamination opportunities, and high holding temperatures all combine to increase the chances of compromising product safety.

Auditors observed several post cook handling errors that resulted in cross-contamination. In one store, at least 50 individual orders of cooked, seasoned shrimp were returned to the bags used to weigh the raw products. When seasoning was requested, employees dipped dry seasoning powder with a spoon and mixed with cooked shrimp. This spoon was then stored in various locations: (a) in the seasoning mix, and (b) on top of the steamer, etc. The spoon was never cleaned and sanitized between uses.

A Standard Operating Procedure Designed to Minimize Food Safety Risks

Table 7-1 summarizes the quality and safety errors observed during the custom cooking routines at cooperating outlets, and presents a proposed SOP that minimizes the opportunities for these errors to occur.

Developing Proper Cooking Schedules

Cooking trials need to be done to meet public health requirements and ensure consistent quality of steamed products. Because of the variation in steamer equipment and the products to be cooked, it is difficult to provide many per se recommendations. However, the trials should be carried

Table 7-1. Solving Current Quality and Safety Problems Encountered When Steaming Shrimp for Individual Customers

SOP Objective	Current Approach Revealed Through The Audits	Proposed Solution
Adequate Cooking to Destroy PathogensWhile Not Overcooking The Order	Shrimp was the only SKU custom cooked during the audits. Employees generally used a per se' rule which stated so many minutes of cooking per pound. Shrimp steamed for 5 minutes per pound resulted in a very safe product (average product temperature 200°F), but one which was judged to be overcooked thereby resulting in a tough, somewhat dry texture.	The ***Food Code*** states that raw animal foods such as eggs, fish, poultry, meat be cooked to heat all parts of the food to 145°F or above for 15 seconds. Reaching this critical temperature depends upon several factors including: (a) initial temperature of the raw product; (b) the size of the item (i.e., 16-20 count shrimp vs. 31-40 count shrimp); and (c) the quantity to be cooked. Such baseline cooking schedules need to be established for each of the various products expected to be steamed to order.
Preventing Various Contamination Venues	Cross contaminating cooked shrimp by repacking them in the same bag used to select and weigh raw product.	Consider using color-coded gloves, pans, packaging and utensils for raw and ready-to-eat lines.
	Cross contaminating the cooked shrimp with the same glove used to select and weigh raw product or recontaminating cooked product with uncleaned, sanitized hands.	The first prerequisite step is washing and sanitizing hands. The ***Food Code*** states that employees cannot handle ready-to-eat products with unprotected hands, so employees must don new disposable gloves before handling cooked product.
	Cross contaminating cooked product from splash that resulted when thawing raw product alongside cooked items.	Establishing standard locations for thawing raw products or staging items to be cooked that are separate from cooked products.
	Cross-contaminating cooked product with unsanitary utensils used to mix shrimp and seasoning.	Holding frequently used utensils like those used to mix shrimp and seasoning in sanitizing dips.
	Cross-contaminating seasoning by using unsanitary utensils to scoop seasoning (from a bulk container) and subsequently mix with cooked shrimp.	Using a shaker to apply seasoning instead of dipping it from a bulk container.
Ensuring Proper Handing and Holding by Consumers	Shrimp are handed off warm to customers who then assume control of the product. The holding temperature is an excellent incubation range for outgrowth of pathogens. Thus, product must be rapidly used or promptly refrigerated.	Use of adhesive, consumer advisory labvels on each package of cooked product to specify rapid use or prompt refrigeration.

out with product having the same initial temperature as an item selected from the service case. Also, cooking trials should be conducted using the approximate quantities generally ordered. Basing heat penetration on a relatively small quantity when most of the time a larger volume is requested could lead to inadequate cooking that may not kill all pathogens. Additionally, the individual size of the item to be steamed — like the count size of shrimp — should be considered too since heat penetration is dependent upon thickness. The *Food Code* states that raw animal foods be cooked to a temperature of at least 145°F for 15 seconds.[1] This should be considered as the minimum thermal processing required at the cook step.

Preventing Various Cross-contamination Opportunities

As Table 7-1 demonstrates, cross-contamination of cooked products occurred through various means. To minimize the risk of subsequently cross-contaminating or recontaminating a cooked product, three elements should be added to departmental operations management. First, establish predefined, standard, separate locations for: (a) staging raw product before placement in the steamer, (b) cooling, seasoning and packing cooked product, and (c) storing perforated steam trays and mixing utensils that repeatedly contact cooked product throughout the day. Second, use color-coded utensils, packaging materials, and gloves for handling raw and cooked products. Third, incorporate a comprehensive but simple-to-understand procedure that specifies the steps of the custom cooking routine where product safety might be compromised: (a) placement of cooked products for cooling, (b) seasoning, packaging cooked products, (c) glove changes, and (d) holding the warm item for the customer.

Predefined, Standard Locations

While every retail store in a chain is different with respect to available square footage, wall space, etc., establishing predefined standard, separate locations for raw and cooked products is an important first step in preventing various cross-contamination opportunities. A spacious department with enough square footage for each function normally completed in full-service seafood departments is, most often, the exception. However, wall shelving, racks, pegs, hooks, etc. can hold many utensils, pans, and packaging materials normally used in retail operations.

Handling errors can be prevented with a few minor, inexpensive changes. Standard locations for staging raw and cooked products should be established. All necessary packaging materials, utensils, etc. for both raw and cooked need to be in the same vertical planes as where the raw and cooked products are staged.

A hypothetical work station in Figure 7-2 illustrates the design elements necessary to establish standard, separate locations for both raw and cooked products, and the gloves, utensils, and packaging materials used with both raw and cooked items. As shown in the diagram, the work station consists of a work table and a wall mounted shelf or rack. The work table has space provided on each side of the steamer for holding cooked and raw material. All raw products to be steamed are staged to the right of the steamer. All functions involving cooked products such as air cooling, seasoning and packaging are completed to the left of the steamer. A similar theme is repeated on the wall mounted shelf or rack. Clear disposable gloves, clear bags, and white foam trays used to handle, select, and weigh raw items are stored on the right side of the shelf directly above the standard work table location for raw products. Likewise, red disposable gloves and red overwrap trays (or bags) are stored above the standard location for cooling, seasoning, and packaging cooked products. Logically grouping handling and packaging materials for raw and cooked products above the standard locations reinforces proper use and facilitates time efficiency since the appropriate items are positioned for easy access.

Utensils like mixing spoons that repetitively contact cooked food need to be rinsed then stored in a sanitizer solution. Seasoning should be applied via a shaker.

Two related cross-contamination concerns were associated with seasoning cooked product, and both can be prevented by predefined, standard locations. Some stores used seasoning directly from a large bulk-packed container. Typically, the employee found a mixing spoon, dipped powdered seasoning out of the bulk container, and used the spoon to mix the spices with the shrimp. This mixing spoon was picked up from various locations including drawers, on top of the steamer, in the seasoning, etc. Auditors never saw the spoon stored in bulk seasoning or on top of the steamer being cleaned and sanitized prior to contact with cooked product or ready-to-eat seasoning. Failure to begin with a cleaned, sanitized spoon effectively cross-contaminates both the seasoning and the cooked product. To prevent the cross-contamination of dry seasoning, a red shaker can be used to apply the spice mix to cooked product. This red shaker is stored on a hook alongside other red handling and packaging materials. The following paragraph addresses how best to prevent repetitively used mixing utensils from cross-contaminating cooked product.

As Figure 7-2 illustrates, two containers below the steamer table hold solutions of sanitizer. These containers are designated as standard locations for equipment and utensils repetitively used in the custom cooking operation such as perforated steamer trays and mixing spoons. Holding mixing spoons in a sanitizing solution ensures a sanitary utensil surface each time the spoon is used to mix seasoning with a cooked product. Obviously, steamer trays undergo the same cooking schedule as the shrimp, crawfish, etc. so any pathogens introduced onto the steamer pan surface during loading would be killed during the cook step. However, the process of repetitive steaming creates a build-up of proteinaceous soils on the pans. These perforated pans have a large surface area that makes effective cleaning and sanitizing difficult. The audit team found that repetitive use throughout the day resulted in a cooked-on film that was difficult to remove with commonly used detergents. By designating a container of sanitizing solution as a standard location for these pans, microflora are effectively controlled, and any build-up on pan surfaces remains hydrated throughout the day. This significantly *reduces* the time to clean perforated steam trays, either at the end of the day or the beginning of the next day.

Sanitizing solutions can be selected from among several classes of com-

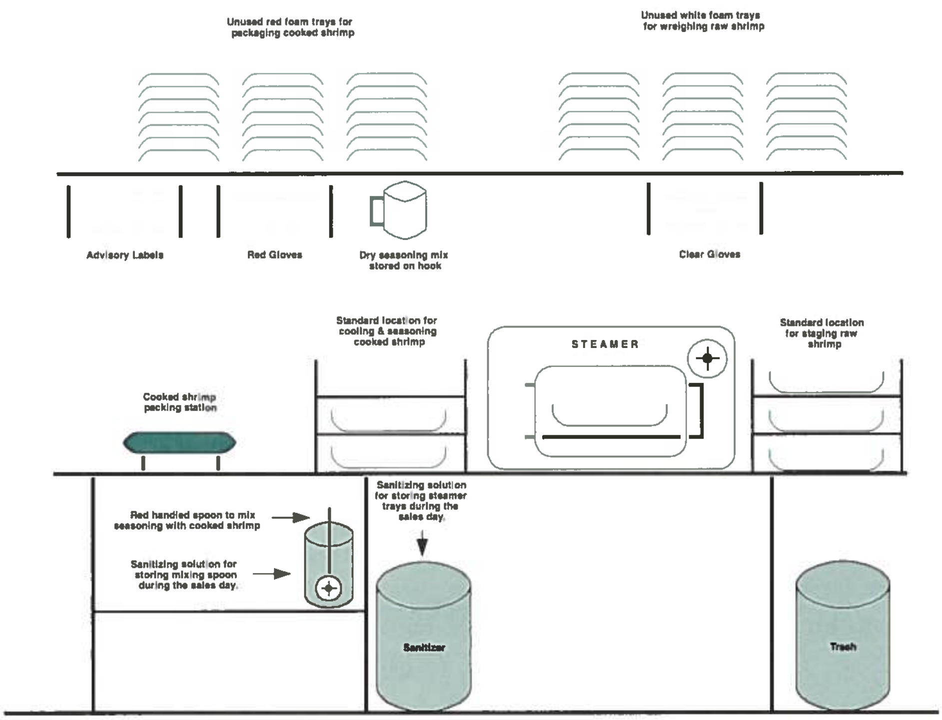

Fig. 7-2. Hypothetical workstation for steaming shrimp or other seafoods within a full-service seafood department.

pounds: hypochlorites, iodophors, and quaternary ammonium compounds. When used according to label instructions, each type of sanitizer is effective. Quaternary ammonium products are the best choice for retail seafood departments. They are effective against biofilms, have a residual effect that helps to control off-odors, and work well as solutions in which to store tools, utensils, and even clean up articles such as mops, etc. (A full discussion of sanitizers follows in Chapter 8.)

Color Coding

Color coding contributes to standard locations for raw and cooked products. Requiring the use of different colored foam trays, bags, and gloves when working with raw or cooked products helps prevent accidental contamination by making such an error immediately obvious. The idea of color-coding is continued with the red-colored seasoning shaker and the red-handled spoon used to mix seasoning with cooked product. By virtue of their colors, employees are cued that these items can only be used for cooked product, and only when hands are protected with red gloves. Color coding also facilitates training in proper use of handling and packaging materials, and provides for quick, accurate compliance checks by management.

Cooked, seasoned shrimp are generally repackaged by hand. Failure to change gloves between selecting a raw item and then repacking a cooked product would also result in cross-contamination.

A Stepwise Procedure Set for Custom Cooking

Standard locations and color coded items are important tools, but alone

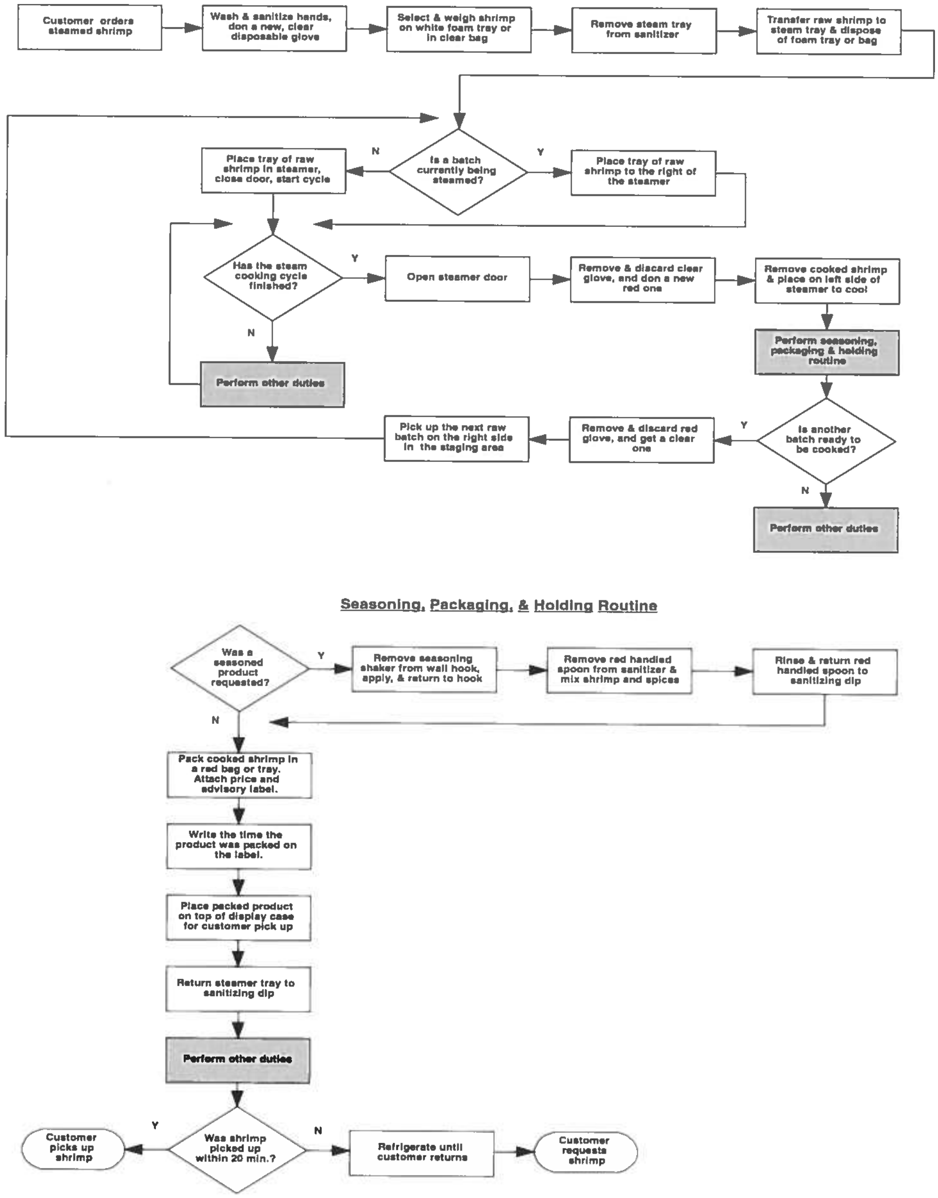

Fig. 7-3. Custom cooking routine in a full-service seafood department.

they cannot insure against inadvertent cross-contamination. Cross-contamination of a cooked product often occurred because the employee forgot a key task, or did something out of sequence. An example would be handling a cooked product with the same gloved hand that originally selected and weighed the raw product. The process flow chart *precisely* defines the necessary tasks and their proper sequence. Knowing what to do and when to do it is essential to make sharp reductions in cross-contamination opportunities (Figure 7-3).

While perhaps intimidating at first glance, only four components comprise the process flow chart. Rectangles represent required tasks. The tasks in each rectangle are broken down into their most basic elements. Each rectangle contains at most two related tasks such as washing and sanitizing hands, removing one glove and donning one of another color, etc. Diamonds represent decision points where one of two courses of action can occur. Directional lines represent the flow from one task or decision point to another. The "Perform other duties" rectangles in Figure 7-3 indicate that, for the moment, the custom cooking SOP is complete and the employee can address other necessary tasks in the department. At some point he returns to the custom cooking SOP, either when the current batch finishes cooking and another one is staged or when another patron asks for a custom cooked product, or once 20 minutes have passed and the employee refrigerates a cooked product awaiting pick-up by the customer.

Of the four elements comprising the custom cooking function, the actual cook step is the most complex step in the diagram because it addresses handling multiple batches, performing other departmental duties while the steamer cycles, and the inherent crossover between raw and cooked inventory. This stepwise procedure specifies which functions to complete with a particular color of glove, and precisely when a glove change is required. It also outlines how time/temperature abuse of the finished product can be minimized.

Ensuring Proper Handling and Holding By Consumers

The fourth element in the SOP for custom cooked seafoods is the use of advisory labels on packaged, cooked products that suggests proper consumer handling necessary to maintain product safety. Such labels highlight the customer's responsibility for rapid use or prompt refrigeration. While this step may appear as strictly a defensive tactic, its utility should not be discounted. Such labels are currently required by USDA for raw beef and poultry products.

Advisory labels should be attached to each order specifying that the purchase be used promptly or refrigerated.

Conclusions

Cooking schedules should be based on (a) initial temperature, (b) expected quantities, and (c) size of item to be cooked (i.e., the count size of shrimp), and (d) an ending product temperature of 145°F maintained for 15 seconds as specified in the *Food Code*. Apart from documenting that *Food Code* requirements are met, this prerequisite step forms the basis for consistently producing a safe, high quality product.

After the item is cooked, it is imperative that the bacterial heat treatment not be compromised by accidental cross-contamination opportunities since no temperature control exists after the cook step. Therefore the next three components of this management plan suggest the behavior required by all employees who perform custom cooking: (a) using predetermined standard, separate locations for raw and cooked products, (b) using color-coded gloves, packaging materials, and utensils, and (c) following a stepwise process for completing the custom cooking function. In particular, these steps should reinforce the following two points: (a) whenever a raw product is handled the gloves, bags, and overwrap trays should be clear or white and (b) whenever cooked product is being handled, any clear glove(s) should be discarded, and a red glove obtained since only red-gloved hands should handle the product, the red shaker, the red-handled spoon, or red bags or foam trays. This makes compliance checks simple, and provides a straightforward message to the employee charged with doing the work.

From a quality and safety improvement standpoint, these elements of the management plan "error proof" the custom cooking function. Collectively, they incorporate a key concept in successful performance improvement activities, notably, explaining precisely how to perform a task. In other words, these elements answer the question posed by a hypothetical employee: *"What would you have me do differently from what I am now doing?"*[2] This procedure set communicates a positive skill or knack and breaks the cycle of improper practices being used. Equally important, these three components generate time efficiency among the employees charged with completing this task. When incorporated into retail operations, these components sharply reduce food safety risks that may result from inadvertent employee actions.

The last element of the plan — use of advisory labels on cooked products — provides a message to customers that they also share in the responsibility to ensure a safe product. Historically, improper consumer handling of certain ready-to-eat seafoods purchased at retail has resulted in major food-borne illness problems that ultimately affected the processor. While an advisory label is a passive component of the interlocking elements of a safety management system, it is an important defensive tactic.

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Chapter 8

Cleaning and Sanitizing

Overview

Chapter 4 identified the preventive strategy as the most effective way to reduce accelerated spoilage across the raw product line and minimize the risk of compromised food safety among ready-to-eat foods. This strategy is based on four equally important, interlocking components: (a) maintaining low product temperatures, (b) using appropriate handling practices so that various contact opportunities are minimized — either among microbiologically dissimilar products or between products and insanitary food contact surfaces, (c) ensuring that those products with the least amount of remaining shelf life have the first opportunity to be sold, and (d) periodically cleaning and sanitizing all food contact and environmental surfaces to reduce the abundance of microorganisms. If sharp reductions in both the chronic, avoidable costs associated with accelerated spoilage and the probability of compromising product safety are to be realized, all four steps of the preventive strategy — including cleaning and sanitizing a variety of environmental and food contact surfaces — must be incorporated into each SOP. For example, if employees follow the procedure identified in Figure 7-3 (page 140) but use an insanitary utensil to mix seasoning with cooked shrimp, product safety becomes less certain. Likewise, using Figure 5-12 or 5-13 (pages 80 and 81) to repack an SKU in an insanitary display pan would derail the entire SOP designed to minimize accidental transfer of bacterial loads from microbiologically dissimilar items. The hand washing step, which begins each procedure presented in Chapters 5 through 7, is the best example of the importance cleaning and sanitizing plays in correctly implementing the various SOPs.

Cleaning and sanitizing procedures are not new ideas to food retailers. Broad scale studies initiated by several universities in the 1960s documented the reductions in shrinkage cost realized from carrying out proper cleaning and sanitizing methods in retail meat departments.[1] Furthermore, virtually all retail managers know the steps required to clean and sanitize fixtures, equipment, utensils and hands. Retail managers still face a major challenge: how to design effective but simple procedures that can be implemented within the man-hours allocated to the department by a single staff member who is simultaneously responsible for other activities.

Designing effective, simple, time-efficient procedures is complicated by the fact that fixtures, equipment, utensils, and hands all must be cleaned and sanitized at different intervals. For instance, most retailers specify a weekly interval for disassembling, cleaning, and sanitizing display cases. Some utensils and tools should be cleaned and sanitized daily. Surfaces like cutting boards and counter tops, which contact a variety of microbiologically dissimilar products during operations, should be cleaned and sanitized before contacting a different SKU, and at day's end.

Hands, the most intensively used food contact surface, should be cleaned and sanitized every 60 minutes and after trips to the restroom, breaks, etc. The cleaning and sanitizing SOPs developed in this chapter are made simpler and more time-efficient by three elements. The first of these is the use of utensils/tools specified in other SOPs. The best example of utensils or tools that simplify the cleaning and sanitizing routine is the display pan system specified in Figure 5-10 (page 78). When pans are used, employees can sharply reduce the frequency of disassembling, cleaning, and sanitizing the display case since only clean ice water flows into the catchment pan. Second, the use of approved detergents for soaking utensils and pans virtually eliminates the need for time-consuming hand scrubbing to remove attached soils. Most of the cleaning is done passively when the utensil or pan is soaked in a detergent solution. Third, investing in detergent and sanitizer metering/apportioning equipment ensures that the correct solution is always used for the task at hand. Collectively, these elements create time savings that allow both department managers and parttime associates to complete necessary cleaning and sanitizing tasks within the time available.

This chapter begins by reviewing the general stepwise procedure required to clean and sanitize fixtures, equipment, utensils and hands. It then discusses the prerequisite steps that ensure the effectiveness of the actual cleaning and sanitizing routine. These prerequisites become additional criteria to evaluate cleaning and sanitizing programs. Subsequently, the current practices and procedures revealed through the audits are summarized. Finally, a series of cleaning and sanitizing SOPs is developed to detail what is required, how to perform each procedure, when it should be done, and who should do it.

A Review of the Cleaning and Sanitizing Procedure

The application of approved chemical compounds alone cannot sanitize a dirty surface. Most of the cleaning and sanitizing process revolves around mechanically displacing soils from food contact surfaces, dispersing these displaced soils in a detergent solution, and finally removing the detergent solution with a clear water rinse. Only after a surface has been cleaned, can chemical sanitizers kill the remaining microbes.

Cleaning involves removing solid and liquid soils by first displacing them from the surface, then dispersing the soils in the cleaning solution, and finally removing the solution from the surface via rinsing.[2] Sanitizing is the subsequent application of heat or chemical compounds to processing surfaces that kill the remaining microbes not removed by the cleaning process.[3] The cleaning and sanitizing procedure is common across all surfaces (Figure 8-1).

As Figure 8-1 illustrates, four of five steps in the sequence concentrate on cleaning. The most important principle to remember about the sequence is that a dirty surface cannot be sanitized. This is because the microorganisms to be destroyed may remain viable in and under the soil, whether that soil is food residue, machine grease, fish slime, etc. A biofilm is an ex-

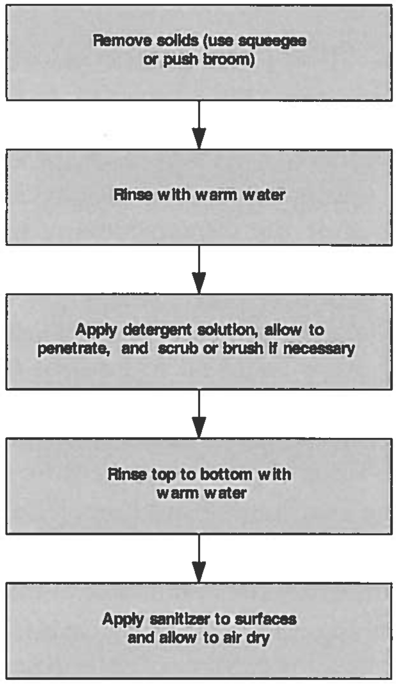

Fig. 8-1. Cleaning and sanitizing sequence for retail seafood departments.

cellent example of what can happen when a proper cleaning routine does not *precede* the application of a sanitizer. A biofilm is a thin, frequently invisible layer of living bacteria and soil that develops over an extended period on surfaces that otherwise appear clean. To prevent the establishment of a biofilm, soils must be routinely disrupted via thorough cleaning with proper detergents and procedures. Even regular use of chlorine or other sanitizers will not prevent biofilm formation unless an effective detergent cleaning program is implemented. Many types of bacteria readily adapt to these micro-layer environments. The pathogen *Listeria monocytogenes* even undergoes a physical change that enhances its ability to attach to surfaces—even smooth stainless steel —thereby decreasing the effectiveness of cleaning and sanitizing agents and making complete removal of the biofilm difficult. Although established biofilms are difficult to remove, the microorganisms living within the films can slough off and be transferred to products that contact them.

Although cleaning and sanitizing are not new ideas, organizing this function so that it can be implemented as a matter of routine remains challenging to virtually all segments of the food industry.

Prerequisite Steps to Ensure That Cleaning and Sanitizing Procedures Are Effective

The five-step cleaning and sanitizing routine is common across all surfaces. However, prerequisite steps build effectiveness into this procedure. For example, employees must know precisely what to clean, how to do it, and which cleaning and sanitizing compounds to use when. They must also have the proper cleaning aids like brushes and scrubbing pads.

While the stepwise procedure for cleaning and sanitizing is clear cut, several prerequisites determine the effectiveness of the generalized procedure shown above in Figure 8-1. Therefore, the cleaning and sanitizing practices observed during the audits are compared against four prerequisite steps required to control (destroy) microorganisms that can compromise food safety or contribute to accelerated spoilage. These prerequisite steps require employees to:

- know what to clean and sanitize, and how to do it;
- clean and sanitize fixtures, equipment, utensils and hands at intervals necessary to minimize the abundance of microorganisms;
- use approved cleaning and sanitizing compounds applied at the concentrations allowed by regulatory authorities;
- Instead of sponges or dish towels that can harbor large numbers of spoilage and pathogenic microorganisms, use scrubbing pads and brushes that quickly dry once cleaned and sanitized.

Because many tools and utensils are mobile and in constant use across microbiologically dissimilar products — both raw and ready-to-eat — standard, separate locations for cleaned, sanitized equipment must be established so that unsanitary items are not accidentally used.

Besides the steps outlined above, employees must separate cleaned, sanitized tools, etc. from those that are dirty. This prevents the accidental use of soiled items that contact food. While maintaining separate, standard locations is not specifically related to creating a clean, sanitary work environment, it is a key consideration since many food contact surfaces within seafood departments are mobile. This would include storage containers, display pans (including inserts and lids), garnish (both edible and inedible), price markers, steamer trays, mixing bowls and utensils, and even cleaning aids like scrubbing pads and brushes. To ensure that employees routinely use cleaned, sanitized utensils, tools, and cleaning aids, it is important that standard locations be established for cleaned, sanitized, mobile items. This issue gains importance when two shifts are involved since the person who may have performed the cleaning and sanitizing routine on a particular item may not be the one who next uses it.

Figure 8-2 highlights the integration of the sequenced cleaning and sanitizing procedure (Figure 8-1) with the prerequisite steps that ensure the effectiveness of the function. The ovals above the generalized procedure suggest the precise approach to use in the cleaning and sanitizing routine—i.e., what to clean and sanitize, how to do it, the elapsed time permissible between cleaning and sanitizing operations, the proper compounds to use, and which cleaning aids to use. The oval below the task sequence ensures that mobile utensils, pans, etc. are distinguished from insanitary items to prevent accidental transfer of microbial loads.

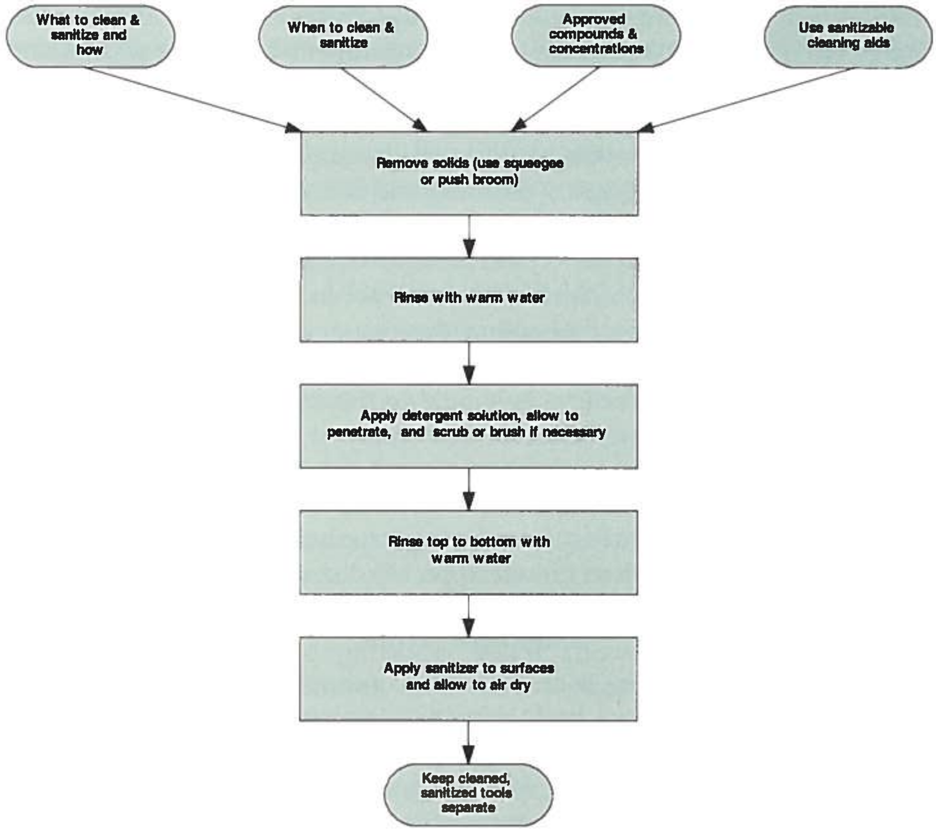

Fig. 8-2. Combining prerequisite steps with the stepwise cleaning and sanitizing procedure to ensure effectiveness.

Current Cleaning and Sanitizing Practices Observed During Retail Operations

Department managers within cooperating firms recognized that odor control and a visibly clean environment were important to sustained patronage. However, this attitude was not translated into a set of stepwise SOPs that could be invoked as a matter of routine. No auditor ever saw any written stepwise procedures that addressed (a) actual cleaning and sanitizing procedures or (b) the five prerequisites necessary to ensure the effectiveness of a cleaning and sanitizing program (Figure 8-2). Not surprisingly, cleaning and sanitizing practices varied widely among stores within the same chain and even within individual stores depending upon who was on duty.

Numerous food contact and environmental surfaces exist in full service retail seafood departments. Each of these surfaces requires cleaning and sanitizing at different frequencies. Auditors observed employees performing some version of the five-step cleaning and sanitizing routine, but most of the time an important step was omitted.

A variety of environmental and food contact surfaces must be periodically cleaned and sanitized during departmental operations. Different amounts of elapsed time are permitted between cleaning and sanitizing various surfaces. Some food contact surfaces like hands should be cleaned and sanitized frequently during the day and when returning from a break or the restroom. Other surfaces like cutting boards and counter tops should be cleaned and sanitized after each use. At the other end of the frequency spectrum, certain machinery like compressors and evaporators should be cleaned and sanitized once a year. However, cleaning and sanitizing such machinery requires special preparatory steps like disconnecting it from power sources, temporarily waterproofing control mechanisms, etc. Consequently, cleaning and sanitizing such machinery is better left to trained staff members who routinely perform troubleshooting and preventive maintenance and are knowledgeable of electricity, electronic controls, etc. Maintenance personnel are in a better position to add cleaning and sanitizing to their other duties associated with this machinery, and these steps would not add materially to their work load. Therefore, the review of current practices is limited to those elements of the department that can be routinely cleaned and sanitized by *department personnel*. There are five such components in all retail departments: (a) employee hands; (b) food contact surfaces like pans, bowls, garnish, price markers, utensils and cutting boards; (c) stationary food processing and preparation surfaces such as countertops; (d) display cases; and (e) floors.

Employee Hands

Frequent hand washing is an essential component of any cleaning and sanitizing program for two basic reasons. First, employees' hands contact hundreds of different surfaces in a given day: (a) microbiologically dissimilar food products, (b) a variety of clean and soiled food contact surfaces, and (c) numerous environmental surfaces, most of which are heavily soiled. Second, body temperature is within the range that supports rapid bacterial growth. Because hands are the common link among utensils, products and environmental surfaces, it has been estimated that well established, routine hygiene practices — notably a proper handwashing regimen—could prevent at least 20 percent of food-borne illnesses.[4] This routine should consist of employees washing their hands with detergent, rinsing them, applying a hand sanitizer, and drying them with single service paper towels. Hands should be washed and sanitized each hour and after returning from breaks, the restroom, etc.

Employee hands are the most intensively used food contact surface, contacting hundreds of different surfaces each day — microbiologically dissimilar food products, both cleaned and soiled food contact surfaces, and numerous environmental surfaces. Employees rinsed their hands frequently, but use of hand soap and a sanitizer was the exception.

All audited departments were equipped with hand washing facilities; however, employees were never observed using the complete routine specified above. Some soap dispensers were empty, and hand sanitizer dispensers or dip stations were almost universally absent. The common practice observed in the audits was for employees to rinse their hands under running water and subsequently dry them on the most convenient article, often a smock or apron. A smock or apron should not be used to dry hands. Bacterial growth on damp, insanitary fabric can be rapid, thus facilitating the transfer of bacterial loads onto hands..

Today, virtually all firms require employees to don single use gloves when selecting a product for a customer, and to replace that glove when the customer requests more than one item. As pointed out in Chapter 5, wearing disposable gloves to serve customers is a universal practice; however, *the use of gloves is not a common practice when stocking the case or removing products at day's end.* Also, using disposable gloves does not eliminate the need for frequent hand washing since pathogenic and spoilage bacteria are easily transferred from dirty hands to clean gloves as they are donned.

Pans, Bowls, Utensils, Garnish and Price Markers

Pans and bowls were customarily rinsed before they were used. However, auditors generally saw no evidence of traditional cleaning and sanitizing routines that begin by soaking pans in a detergent solution, scrubbing (if necessary) to remove any adhering soils, rinsing with clean water, and subsequently dipping or spraying with a sanitizer. As addressed in Chapter 5, this oversight is a particular concern because pans, bowls, and utensils are in constant use across both raw and ready-to-eat product lines.

Pans and bowls used to display raw items were rinsed but not subjected to the five step routine illustrated in Figure 8-1.

In one cooperating department where auditors observed employees mixing ready-to-eat seafood salads, the utensils used in that operation were detergent cleaned and placed in a drawer. In another department within that firm, auditors found heavily soiled spoons used to mix seasoning with cooked shrimp located atop the steamer unit suggesting that cleaning and sanitizing these utensils was not part of the daily routine.

In one cooperating store, utensils for mixing seafood salad were detergent cleaned and placed in a drawer — meeting some but not all of both the five-step routine and the prerequisites.

In those stores where an edible garnish was used, it was typically rinsed under running water before placement in the case. Typically edible garnish was discarded after one day's use. This one-day use cycle is important from a sanitation standpoint because, if reused, the garnish would serve as an excellent pathway for transferring bacterial loads across microbiologically dissimilar products.

In one store, auditors found an inedible garnish that was not used because of a visible build up of proteinaceous soils that employees felt detracted from the overall appeal of the service case. When questioned about why such artificial garnish was not used, employees said that too much time was required to hand detail the seventy or eighty individual leaves. However, an overnight soak in an approved alkaline detergent solution would lift those soils with virtually no hand scrubbing.

Artificial garnish was not used because employees said that too much time was required to remove the visible build up of soils on each leaf. An overnight soak in a properly mixed detergent solution would passively lift those soils.

Auditors observed that when the display case was unloaded for the night, price markers were placed in various locations including the storage cooler, or on a work table. The next morning, auditors in some stores observed employees rinsing the markers before using them, but, they were not subjected to a traditional cleaning and sanitizing step before reuse. In other stores, price markers were used the following morning without being rinsed.

Product Processing and Preparation Surfaces

Cooperating firms periodically wiped counter tops to restore a visibly clean surface, but most often counter tops were not detergent cleaned or sanitized. However, in one outlet employees used a spray bottle of quaternary ammonium sanitizer (quat) as a combination cleaner/sanitizer, which is an excellent way to maintain a visibly clean and sanitary surface between uses. In another cooperating firm, an auditor observed an employee applying an aerosol, food-grade lubricant across all counter tops and product preparation surfaces before close down. The net effect of this practice was to create more initial clean up time for the morning employee who had to wipe off all surfaces before using them. More importantly, once the oil was removed, the morning employee should have applied a detergent, possibly performed some hand detailing with a scrubbing pad or brush, rinsed with clear water, and applied a sanitizer. Auditors did *not* observe this sequence of events.

Display Case

The display case presented a unique cleaning and sanitizing venue. Because of its design, most of the time spent to clean and sanitize refrigerated display equipment was expended in disassembly. Once employees reached the catchment pan, the cleaning and sanitizing routine only consisted of flushing the pan with water — no scrubbing, and no application of a sanitizer.

Cleaning and sanitizing the display case usually happens once a week, and not all audits coincided with cleaning and sanitizing that fixture. In one cooperating firm, case cleaning was observed across two departments; however, the approaches were quite different. In one store an employee removed doors, product, garnish, and price markers, shoveled out the bed ice, removed the ice rack, then simply rinsed the glass area and catchment pan with a hose. No hand detailing with a brush or scrubbing pad was observed. Detergents and sanitizers were not used. Most of the dedicated time was spent disassembling and reassembling the apparatus. In another store, a similar approach was used, but the glass areas were cleaned with a household ammonia-based spray glass cleaner. Auditors saw no other cleaning or sanitation compounds being used at this location. Employees charged with disassembling, cleaning, and sanitizing the case in another cooperating chain methodically removed the glass doors each evening, washed them with a detergent solution applied with a wiping cloth and rinsed with a wiping cloth and clear water.

Floors

During each of the three-day audits, cooperating departments used varying clean up procedures on floors. In one chain, the floor was washed down with hot water just before closing for the evening. No detergent was used, nor was any sanitizer applied. The floor in another chain was mopped with a detergent solution and rinsed with the bucket and mop. The employee of one firm with a wall-mounted proportioning system introduced a detergent solution onto the floor via a hose, allowed it to penetrate for a few minutes, and then rinsed with clean water.

Floor drains are among the first places contaminated with the pathogen *Listeria monocytogenes*. Therefore, a serious problem can occur when employees aim high pressure hoses into these drains. High water pressure creates aerosols that can settle on any food contact surface above the floor, such as processing and preparation surfaces, utensils, and tools. If allowed to grow anywhere in the department, listeria is likely, at some time, to be transferred to products.

Seafood market surveys suggest that up to 25 percent of products may contain *Listeria monocytogenes.* Items in the mix include some ready-to-eat seafoods (cooked shrimp and salads) and raw fish.[5,6] Recent awareness by processors has resulted in improved control of potentially hazardous products such as smoked fish and surimi. Because today's full service retail departments and processing facilities are equally complex, retailers must take affirmative steps to control this pathogen. Food retailers should know that the presence of *Listeria monocytogenes* on ready-to-eat foods is sufficient to invoke injunctions, recalls and public announcement. Similar policies exist for other pathogens, including salmonella and *E. coli* 0157:H7.

A Summary of Observations Related to Cleaning and Sanitizing

When the cleaning and sanitizing functions of all cooperating departments were evaluated against the five prerequisite steps and the stepwise cleaning and sanitizing procedure illustrated in Figure 8-2, no department approached a comprehensive, effective cleaning and sanitizing routine that could be applied as a routine. In fact, were a single hypothetical cleaning and sanitizing procedure to be constructed from the correct approaches observed across all cooperating departments, this procedure would still have several important omissions

For instance, nowhere did auditors find reminder posters about what to clean and sanitize, and how to go about doing it. Auditors noticed employees apparently following their own versions of what to clean and how best to do it. When asked how they knew what to do, most employees suggested that the approach they were following was based on verbal instructions passed along by the department manager. Intervals for periodically cleaning and sanitizing certain food contact surfaces like countertops and food preparation surfaces throughout the day were not specified either. One department had a detergent/sanitizer metering system that delivered approved compounds from bulk storage; however, this was the exception among cooperating stores. Some tools, like pans, were in constant use, so separation of clean, sanitary items from those that are dirty was moot. In some departments, auditors found no standard locations for storing utensils routinely contacting ready-to-eat products.

Most of the cleaning and sanitizing activities took place toward the end of the day. Across all cooperating firms, cleaning and sanitizing procedures seemed to focus on ensuring that departmental surfaces were visibly clean as opposed to being *clean and sanitary*. Almost universally, sanitizer was not applied to cleaned surfaces. Auditors observed only one outlet that employed the cleaning and sanitizing routine specified in Figure 8-1 (page 145), and in that store, the procedure was used only on floors and processing/preparation areas; not other food contact surfaces like utensils, price markers, etc.

The priority of cleaning and sanitizing within cooperating departments ranged from "something to do if time permits" to a daily regimen that was laborious. In cooperating departments that performed periodic cleaning, auditors observed the use of "off the shelf" consumer cleansers. Though effective in household applications, these products are less effective at *passively* removing the types of soils found on food contact surfaces in seafood departments (i.e., lifting soils via soaking). Therefore, hand scrubbing is required to remove stubborn soils. Inevitably, hand detailing is not completed because the time necessary to do so is committed to other priorities. Using the artificial garnish found in one department as an example, auditors found these leaves not being used because (a) the detergent could not passively lift soils off each leaf and (b) the time required to hand detail each leaf on a daily basis was generally not available.

Historically, the omissions noted above would be reflected in higher shrinkage costs. However, with a growing line of ready-to-eat products sold through full-service seafood departments, improper cleaning and sanitizing of hands, utensils, equipment and fixtures can compromise product safety thereby affecting the entire corporation. Fortunately, building effectiveness into the cleaning and sanitizing function is relatively easy.

A Set of Standard Operating Procedures Designed to Correct Cleaning and Sanitizing Errors

Proper cleaning and sanitizing improves performance in several ways. First, off odors are sharply reduced. Second, maintaining sanitary food contact surfaces minimizes accelerated spoilage of raw products and reduces the chances of transferring pathogenic bacteria or viruses onto ready-to-eat foods.

Two primary differences exist between the SOPs described earlier in the text and SOPs presented in this chapter. First, in other SOPs outlined throughout Chapters 5, 6 and 7, a single SOP was designed to meet the first three elements of the preventive strategy. Conversely, ensuring clean, sanitary surfaces during departmental operations — the last element in the preventive strategy — requires several SOPs primarily because of differences in the frequencies necessary to control microorganisms across a variety of food contact surfaces, non food contact surfaces, and environmental surfaces. The second difference between other SOPs and those that follow is relative complex because previous SOPs outlined in this text span several days and often require that decisions be made. On the other hand, the cleaning and sanitizing SOPs presented in this chapter are invoked at predetermined periods, take short amounts of time to complete, and require no decisions. For instance, repeated reference has been made to the frequency of hand washing, yet the hand washing routine should require less than a minute.

Consistent with other SOPs introduced in this text, an effective cleaning and sanitizing program is less dependent upon choosing the right detergent or sanitizer, and more dependent upon establishing effective procedures that can be applied routinely by unsupervised personnel.

Figure 8-1 (page 145) illustrates the sequence of steps required to clean and sanitize a surface, and Figure 8-2 (page 147) highlights the prerequisite steps necessary to make these steps effective. This set of SOPs carries out the ideas behind Figure 8-2 by specifying the specific tasks required to control microorganisms on fixtures, processing and preparation surfaces, utensils, and hands. This section begins by adding more specificity to the prerequisite steps illustrated in Figure 8-2. Initially, the various classes of approved detergents and sanitizers are reviewed. An understanding of these compounds and the available choices is important in making subsequent decisions about metering systems, and the features associated with these devices. The proper types of cleaning aids are also discussed since the choice of cleaning aids used has a significant impact upon the effectiveness of the cleaning process. Questions about what to clean and sanitize and how best to do it are answered in the form of structured, sequenced SOPs.

Approved Cleansers and Sanitizers

Detergents are commercial cleansers that release dirt and food residues from surfaces. Three primary classes of detergents are available to retailers: (a) general purpose, (b) alkaline, and (c) chlorinated detergents. These are listed from least to most effective for removing the mixed protein-fat soils most often encountered in seafood and meat departments (Table 8-1). Although highly effective, retailers should use the alkaline and chlorinated detergents with caution as these are very aggressive cleaning agents and may corrode metals and destroy organic materials such as leather. Chlorinated detergents are both highly alkaline (caustic) and strongly oxidative, requiring special handling and training. They are not recommended for most retail applications.

Sanitizers (also called disinfectants) are compounds that kill bacteria. Three classes of FDA approved sanitizers are most commonly encountered in retail seafood departments: (a) hypochlorites, (b) iodophors, and (c) quaternary ammonium compounds (i.e., quats) (Table 8-2).

Hypochlorites are fast acting and very effective when applied to clean surfaces. Commercial "bleaching powders" (usually calcium hypochlorite) are relatively stable in storage and may be less caustic than sodium hypochlorite (liquid bleach). Solutions of these compounds are effective against a broad spectrum of microorganisms, including some spoilage bacteria resistant to quats. They are a good choice for tool/utensil dips and sanitizing work areas when used at concentrations of about 100 parts per million (ppm). The lower end of this range is recommended for hands since adverse skin reactions are a common complaint. Do not confuse these products with household or industrial scouring powders, which should not be used. Also, the FDA discourages the use of household bleach (unapproved sodium hypochlorite) as a hand dip.

Iodophors (iodine-based sanitizers) are less corrosive substitutes for hy-

Table 8-1. Detergents and Their Applications for Seafood Retail Departments.

Detergents	Advantages	Disadvantages	Common Usage	Concentration
General Purpose (GP)	Non-caustic, safe to people and equipment, good general cleaners	Generally ineffective against boiofilms and other difficult soils	Cleaning that requires hand/skin contact, general housekeeping	as labeled
Alkaline	Generally effective at loosening mixed seafood soils (protein, oils), caustic but less so than chlorinated detergents	May require more contact time or scrubbing than chlorinated detergents	Seafood preparation areas, painted surfaces (walls), implement soaks	as labeled
Chlorinated (chlorinated alkalines)	Aggressive removal of seafood soils and Agbiofilms, least hand detailing required	May damage corrodible equipment and painted surfaces, gloves required	Stainless steel, plastic cutting boards, floors, heavily soiled areas	as labeled
Acid	Effective for removing stains and mineral soils	Generally less effective for complex food soil removal than others	Occasional use for restoring bright finish to stainless steel cases, sinks, plastics	as labeled

Table 8-2. Sanitizers and Their Applications for Seafood Retail Departments

Sanitizers	Advantages	Disadvantages	Common Usage	Concentration
Chlorine (hypochlorite)	Rapid kill, effective against nearly all microorganisms	Inactivated by seafood or other soils (apply to clean surfaces), may irritate skin, requires periodic replacement or test paper check	Whole department sanitation, hand and equipment dips	Food contact:: 100 ppm Non-food contact: 200ppm
Iodine (iodophor)	Rapid kill of nearly all microorganisms, somewhat more stable than chlorine, allows visual check for concentration	May stain hands and equipment (mostly at higher contrations)	Hand and utensil dips	25 ppm
Quaternary Ammonium Compounds (quat)	Long residual effect, least affected by soils, good odor control, recommended for Listeria	May not kill all types of bacteria	Floors, drains, coolers, areas that are not always cleaned before sanitizing	Food contact: 200 ppm Non-food contact: 400 ppm

pochlorites, and are commonly used at concentrations of 25-35 ppm. Visual verification of strength by employees and managers is one of the most significant attributes of iodophors. The color changes from reddish yellow to straw yellow to clear as the sanitizer is depleted during use. However, many companies do not use iodophors due to their tendency to stain skin, clothing and work areas. Usually this problem results from using sanitizer concentrations greater than the recommended 25 ppm, but even these solutions may stain plastics and porous materials even when routinely applied. The advantages of iodophors generally outweigh disadvantages when used for hand and utensil dips. These sanitizers should be prepared and used at room temperature. As with other sanitizers, iodophors can transfer off-flavors to products if higher than recommended concentrations are used or if surfaces are not allowed to drain prior to contacting food.

Many retailers have shifted from hypochlorites to quats because of their effective odor control. Quats are relatively slow acting. However, they are stable in solution and have a long residual effect. They are effective for *Listeria* control and are well suited for use on floors, drains, coolers and display cases. Because they are somewhat resistant to depletion by organic material such as fish slime, quats need only be intermittently applied during the day to work stations and utensils. However, these surfaces must be well drained before recontact with food, and should be detergent cleaned daily. Quat concentrations of approximately 200 ppm are recommended for food contact surfaces. Solutions of approximately 400 ppm are preferred for floors, cooler walls and other environmental surfaces. If these more concentrated quat solutions are used on food contact surfaces, they must be rinsed off prior to use. Because quats are relatively slow acting, the FDA discourages their use as hand dips.

Water Temperature

Water temperature of detergent solutions should be very warm for effective release of soils, but not greater than 160°F. Very hot water cooks proteinaceous soils onto surfaces making them far more difficult to remove. Worker safety is also a concern when very hot water is used. On the other hand, sanitizers are best applied as cool to warm solutions. Certain types of sanitizing compounds like hypochlorites dissipate rapidly above approximately 120°F and are thus rendered ineffective.

Cleaning Aids That Prevent Recontamination During Cleaning Procedures

Cleaning aids that retain liquid, such as sponges, mops and wiping cloths, often harbor large numbers of microorganisms, including potential pathogens. Such products may transfer and redistribute large numbers of bacreria rather than actually clean surfaces. More effective alternatives are available. Plastic scouring pads products are highly effective for hand cleaning of utensils, equipment parts, counters, etc. and are less prone to retaining contaminants since they rapidly drain. If less scrubbing effort is needed, brushes can be very efficient. As with push brooms, brushes should be all plastic, with bristle stiffness appropriate for the job. Cleaning aids like plastic scrubbing pads and brushes should be treated like other food contact surfaces. Between uses, they should be cleaned, sanitized and placed in a rack to dry. Alternatively, plastic scrubbing pads and brushes can be cleaned and stored in sanitizer solution. Importantly, sanitizer concentrations diminish with exposure to both solid and liquid soils. If such sanitizer solutions are not changed on a daily basis, the solutions themselves can serve as reservoirs for a variety of microorganisms thus allowing transfer and redistribution during the cleaning process.

A cleaned, sanitized squeegee effectively strips sanitizer from food contact surfaces such as cutting boards and other flat surfaces during the work day. Alternatively, disposable paper towels can be used to wipe sanitizer from the surface immediately before use.

Sponges and mops may be needed periodically for picking up spills. Although these cleaning aids are for environmental surfaces, they should be cleaned regularly and stored in a sanitizer solution.

Ensuring Proper Detergent and Sanitizer Concentrations

Tables 8-1 and 8-2 highlight the importance of using correct concentrations of both cleaning and sanitizing compounds. Additionally, an effective cleaning and sanitizing program must be performed throughout the day. This suggests that both the more experienced department manager who typically opens the department and the parttime associate who typically closes it must properly use cleaning and sanitizing compounds. The best way to prevent improper concentrations — either too little or too much — is with a metering system that dispenses these compounds at predetermined concentrations as they are mixed with water. Such metering systems can be plumbed so that they dispense through a hose, into a compartmentalized sink system, or through a valve for filling buckets. If quats are used, dispensers must deliver more than one concentration of a sanitizer. Specifically, 200 ppm is recommended for food contact surfaces, but 400 ppm is recommended for non food contact surfaces. As such, the dispenser must have orifices designed to deliver these two concentrations.

Building Effective, Simple Cleaning and Sanitizing Standard Operating Procedures

A program that efficiently controls microorganisms throughout the retail department is less dependent upon the choice of approved detergents and sanitizers and more dependent upon people and procedures.[7] First, many surfaces must be cleaned and sanitized at different intervals throughout the day. Second, cleaning and sanitizing — like all other functions required in full-service retail departments — are generally completed without management oversight. Thus, employees (both afternoon/evening associates and department managers) need to know what is expected and precisely how to complete the task. Therefore, procedures need to be simplified and streamlined so employees can complete mandated tasks in a timely fashion. Third, many steps in the cleaning and sanitizing function can be inadvertently omitted, but these omissions are not immediately obvious to management. As with accidental transfer of bacterial loads across microbiologically dissimilar products, though, the damage manifests itself later. Table 8-3 summarizes the cleaning, sanitation and personal hygiene errors observed during the audits at cooperating outlets, then presents a proposed set of SOPs to correct these errors.

To correct the errors observed in the audits, Table 8-3 suggests that six of nine different SOPs must be completed throughout each day to maintain a clean, sanitized department. Completing six different cleaning and sanitizing SOPs each day, in addition to other duties, would appear to violate the principles of time-efficiency and simplicity. However, each of these six procedure sets represents a slight variation in the simplistic

Table 8-3. Solving Cleaning and Sanitizing Errors With Standard Operating Procedures		
Surface	Current Approach Revealed Through The Audits	Proposed Solution
Employee Hands	Generally rinsed under running water, soap not used, sanitizing hand dips or instant sanitizers not available, hands dried on various unsanitary articles (e.g., smocks, aprons, etc.	**Hourly and upon returning from restroom breaks —** **Perform Hand Wash SOP**
Display Pans, Bowls, and Assorted Utensils	Display pans containing previously displayed merchandise — Pans were in constant use. Generally rinsed under running water before reuse — no detergent, no scrubbing, no sanitizing step Steamer pans and utensils used periodically in custom cooking operations — Most steamer pans were heavily soiled, exhibiting a cooked-on film. This was more of a cosmetic issue rather than a food safety concern. Serving utensils, etc. used daily — Generally most employees placed articles in sink and cleaned with household detergent. Sanitizing step not completed. Only three outlets had standard locations for cleaned equipment.	Display pans containing previously displayed merchandise — **Perform Previously Used Pan SOP** Steamer pans and utensils used periodically in custom cooking operations — Upon opening the department — **Perform Steamer Tray and Tools SOP** Upon close down — **Perform Day's End Pan/Utensil SOP** Note: This step may be initiated by the parttime employee but completed by the manager at the beginning of the next day. Serving utensils, etc. used daily — **Perform Day's End Pan/Utensil SOP**
Stationary Food Processing and Preparation Equipment	Between uses throughout the day — Most cooperators wiped down or rinsed off surfaces, but detergents and sanitizers were not routinely used in the vast majority of departments audited. Daily at close down — No common approach. One firm applied a food grade lubricant to countertops. Another firm used the sequence shown in Figure 8-1.	Between uses throughout the day. — Prior to placing a different item on a processing or preparation surface **Perform Between Uses SOP.** Daily at close down. — **Perform Day's End Work Table SOP.**
Display Cases	Frequency (weekly) and approach was fairly consistent across cooperating firms that included removing contents, melting ice, removing ice rack, rinsing catchment pan and surroundings. No detergent or sanitizer was used on wet pan or evaporator.	Every other day (when pans are used) — **Perform Catchment Pan SOP.** Monthly (when pans are used) — **Perform Display Case SOP.**
Floors	Some firms used a mop and bucket, others rinsed with a hose. Another firm applied a detergent solution via hose, and applied a quat solution with the hose.	Daily (or as needed) — **Perform Floor SOP.**

stepwise procedure found in Figure 8-2 (page 147). Furthermore, these six SOPs are spread out over the entire work day, and are shared about equally by both the manager who typically opens the department and the employee who closes it. Only two of the six SOPs are normally repeated during daily operations: the "Between Uses SOP" that ensures a clean, sanitary processing surface each time a different SKU contacts it, and the "Hand Wash SOP." The "Between Uses SOP" typically occurs in the morning in those departments that process one market form into another. However, the parttime staff member may also need to invoke this SOP during certain times of the year when firms establish selling prices for relatively unprocessed market forms (i.e., whole or headed and gutted), but then offer custom processing. The "Catchment Pan SOP" is performed approximately every other day. *The "Display Case SOP" enumerated in Table 8-3, which specifies disassembling, cleaning and sanitizing the refrigerated service case, is not a daily, or even weekly requirement if display pans are used for 100 percent of displayed inventory.* A tenth pre-operational SOP not enumerated in Table 8-3 is also suggested to ensure that essential supplies are available to complete required cleaning and sanitizing tasks during the day (Figure 8-3). To put these SOPs into some logical structure, Figure 8-4 overlays each SOP required as part of daily operations on a grid of various food contact and environmental surfaces and time of day. Each SOP group except the "Pre-Operational SOP" will be discussed.

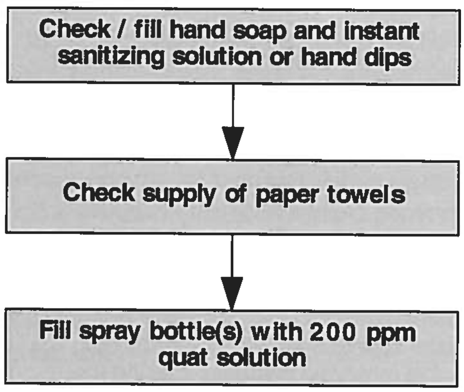

Fig. 8-3. Pre-operational SOP

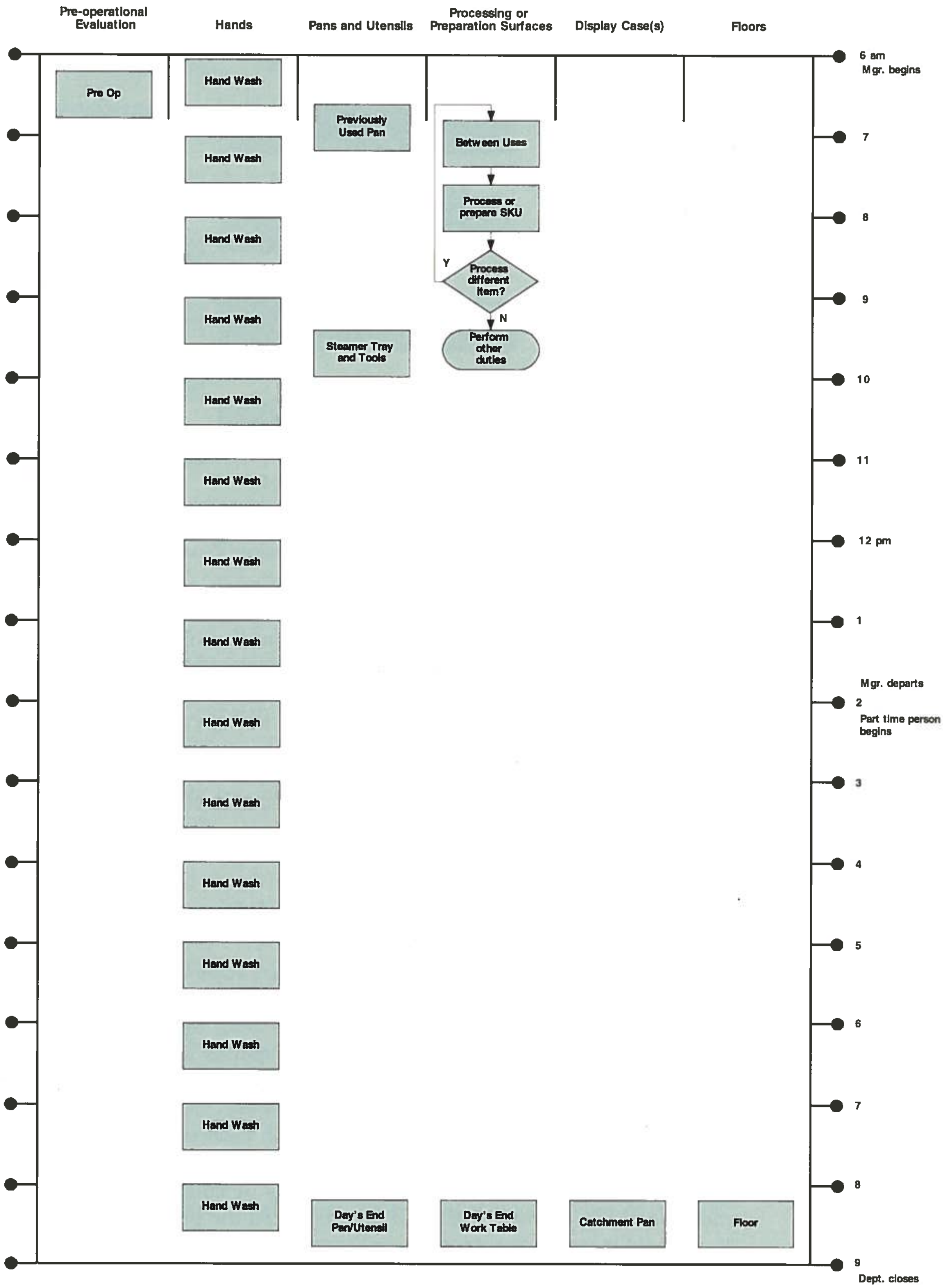

Fig. 8-4. Cleaning and sanitizing SOPs required each day overlain across various food and non-food contact surfaces and through time.

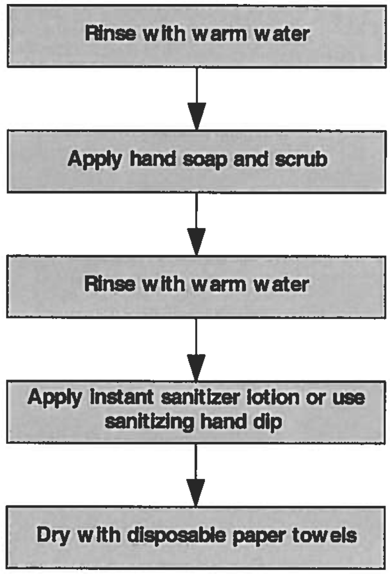

Fig. 8-5. Employee hand wash SOP

The Hand Wash Standard Operating Procedure

Figure 8-5 illustrates the steps required to wash and sanitize hands. Firms have two primary choices for sanitizing cleaned hands: a dip station that is typically a 25 ppm solution of an iodine-based sanitizer or an instant sanitizing lotion, frequently dispensed like liquid hand soap. Dip stations are common across food processing operations where many employees pass through predetermined entry points when returning to the processing floor after trips to the restroom, breaks, etc. Dip stations are economical in such settings. While relatively expensive in food processing operations, the *Food Code* also identifies instant, alcohol-based sanitizing solutions as an effective approach to hand sanitation in departments typically staffed by a single individual.[8]

Standard Operating Procedures Used in Cleaning and Sanitizing Utensils, Pans and Trays

Figure 8-6 illustrates a set of three interrelated SOPs that clean and sanitize various mobile equipment such as (a) pans used in the display step, (b) utensils used to custom pack bulk packed items like shucked oysters and seafood salads, and (c) trays and mixing spoons repetitively used in custom cooking operations. The left-most procedure, known as the "Previously Used Pan SOP," is typically completed as previously displayed merchandise is repacked the following morning in cleaned, sanitized display pans so that it can be sold first. This SOP dovetails with the SOP shown in Figure 5-13 (page 81). This SOP would logically be completed early in the morning as the manager evaluated and repacked the previously displayed but unsold merchandise. Once the manager completed the task of repacking yesterday's unsold merchandise, he could invoke the "Steamer Tray and Tools SOP." This SOP prepares the sanitizing solutions used in the custom cooking operation where steamer trays and mixing spoons are held in

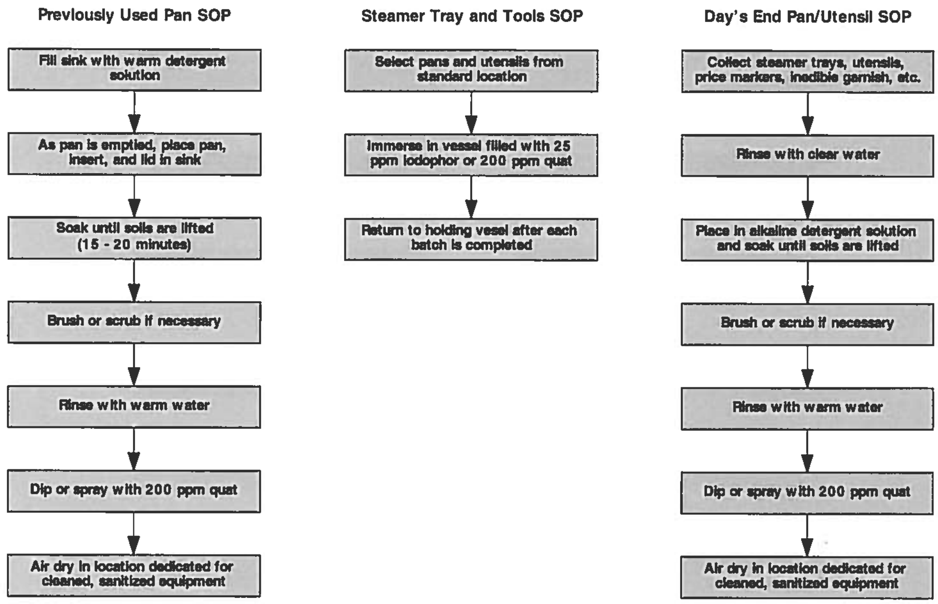

Fig. 8-6. SOPs for cleaning and sanitizing display pans containing previously displayed merchandise during the morning, readying steamer trays and utensils for batch operations, and cleaning and sanitizing assorted pans, steamer trays, utensils, price markers, etc. at day's end.

sanitizing solutions. It is a preparatory step, and corresponds with Figure 7-2 (page 139). At day's end, the employee would carry out the "Day's End Pan/Utensil SOP" that *initiates* the cleaning and sanitizing of price markers, artificial garnish, serving utensils, steamer trays and mixing spoons (i.e., he or she would complete the first three steps). If time permitted, the entire SOP could be completed in the evening; however, this SOP could be completed the next morning if other steps steps pre-empt completion.

A key element in Figure 8-2, which ensures the effectiveness of the firm's cleaning and sanitizing function, creates dedicated, separate locations for storing cleaned, sanitary utensils and tools to prevent inadvertent use of dirty, insanitary items. While the idea is clear, doing it is dependent upon the physical plant of the department. However, some per se' suggestions can be made. In most cooperating departments, auditors noted a lack of storage space (cabinets or wall shelving). Yet, most departments used a variety of serving and mixing bowls, utensils, knives, etc., suggesting the need for standardized, dedicated storage. Wall mounted shelves above a compartmentalized sink can hold cleaned, sanitized display pans, inserts, and lids along with other utensils. If space for shelves is limited or architecturally prohibitive, grocers should consider specialized rolling carts that can be outfitted with various combinations of shelving, racks, hook systems, etc. for holding different types of cleaned, sanitized equipment.

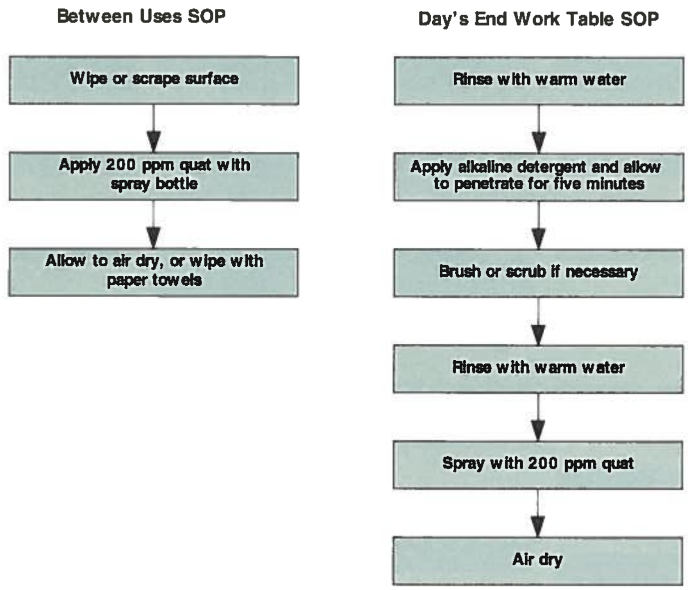

Fig. 8-7. SOPs for cleaning and sanitizing processing and preparation surfaces between uses and at day's end.

Standard Operating Procedures Used in Cleaning and Sanitizing Stationary Processing or Preparation Surfaces

Two SOPs are required to clean and sanitize various fixed food processing and food preparation surfaces (Figure 8-7). The "Between Uses SOP" diverges from the generalized cleaning and sanitizing procedure found in Figure 8-2, and concentrates on superficially cleaning the surface with a squeegee (dedicated only for food contact surfaces) or disposable paper towels, then spraying with a 200 ppm quat solution and either wiping off or allowing the surface to air dry. Because quats are resistant to depletion by organic material such as fish slime, they are an effective compound for destroying microorganisms between repetitive uses of processing equipment. As Figure 8-4 illustrates, the "Between Uses SOP" would be repeated before a different SKU contacted a processing or preparation surface. Importantly however, this "Between Uses SOP" is not a substitute for a more thorough daily cleaning and sanitizing regimen completed in the evening, or whenever such surfaces are no longer needed. A more thorough cleaning and sanitizing routine is completed by following the "Day's End Work Table SOP." Recall that without the periodic (daily) disruption of soils by a cleaning step (the use of detergent solutions and mechanical/physical removal through scrubbing or brushing), biofilms can form that are relatively unaffected by the application of sanitizers.

Standard Operating Procedures for Cleaning and Sanitizing Refrigerated Service Cases

The overview mentioned that certain tools would simplify the cleaning and sanitizing function. Nowhere is this more apropos than with the refrigerated service case. Customarily, products are placed in the case on paper or shallow plastic or metallic trays, and the catchment pan collects

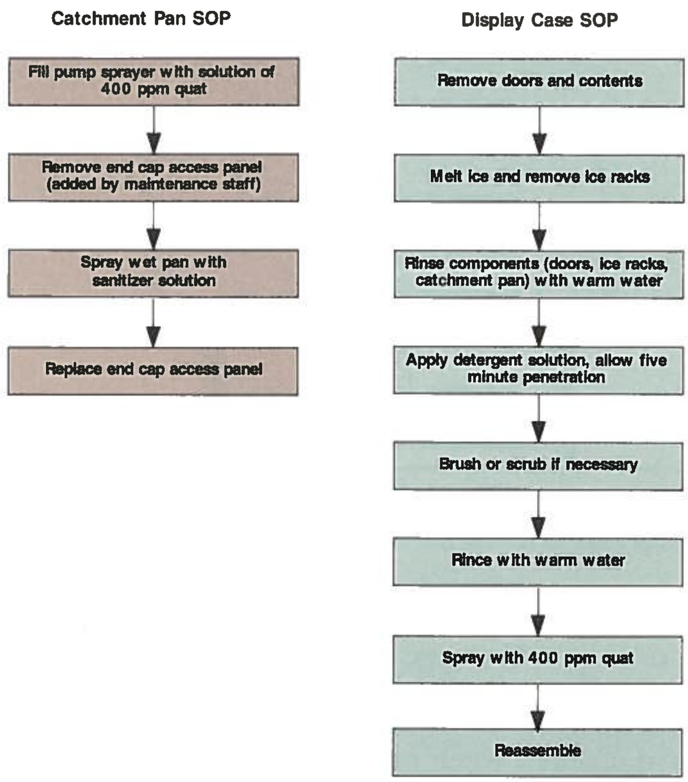

Fig. 8-8. Controlling odors originating from the service case (performed every other day) and a thorough but less frequent cleaning and sanitizing routine.

both ice melt and drip from the products. Because this area stays moist and relatively warm, odors originate from this portion of the case. In the audits, cleaning the refrigerated service case was a labor-intensive assignment completed each week by the parttime associate. Most of the time dedicated to this task revolved around disassembly and assembly, with very little time allocated to cleaning and sanitizing the apparatus.

The "Display Case SOP" (right panel of Figure 8-8) enumerates the steps required to clean and sanitize the case under the common practice of allowing product drip to collect in the catchment pan. This is a time-consuming procedure that must be properly executed if odors are to be controlled between cleaning and sanitizing operations. Without pans, or if pans are used for part of the displayed product line, disassembly, cleaning, sanitizing, and reassembly must be completed at least weekly to control off odors. On the other hand, were pans used, The "Catchment Pan SOP" (left panel of Figure 8-8) highlights the steps required when all bulk packed inventory is displayed in pans. Under this scenario, the afternoon/evening employee could simply spray the area beneath the ice rack about every other day in a fraction of the time required for complete disassembly. Figure 8-9 illustrates the end cap modification required to provide access to the catchment pan. If pans are used, both SOPs will be necessary, but the frequency of the "Display Case SOP" will be about monthly while the "Catchment Pan SOP" could be completed about every other day.

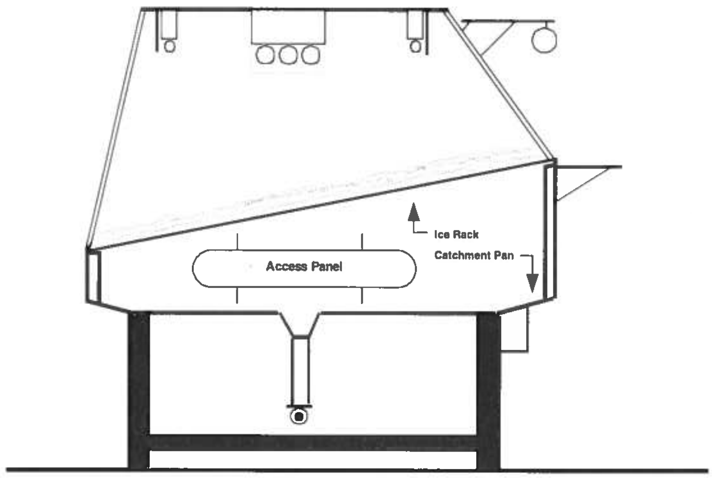

Fig. 8-9. Cross-section of a refrigerated service case showing a removable panel in the end cap used to access the catchment pan.

A Standard Operating Procedures for Cleaning Floors

Visibly clean aisle floors are an important positive cue and food retailers are serious about maintaining their appearance.The floors in meat and seafood departments can be major sources of off odors, and should be cleaned and sanitized when conditions warrant. With the proper equipment and cleaning aids, cleaning and sanitizing the floor can be completed in just a few minutes (Figure 8-10). Once the dry pick up is completed, the floor should be rinsed with warm water through a nozzle that delivers a controlled, low volume, low to medium pressure spray. Next, a detergent solution should be applied via a metered system through the hose, and allowed to penetrate. If hand detailing is necessary, it can be done with a push broom. Once the hand detailing is completed, the floor can be rinsed with warm water followed by a 400 ppm quat sanitizer. (To prevent the formation of aerosols containing pathogens such as *Listeria monocytogenes* that may settle on food contact surfaces, a pressure water stream should never be directed into a floor drain.)

Conclusions

Clean, sanitized hands, tools, and stationary fixtures are an integral component of the preventive strategy.The purpose of this chapter has been to create a set of effective, simple, time-efficient SOPs that ensure environmental and food contact surfaces remain clean and sanitary. The general procedure for ensuring clean, sanitary surfaces is widely known. However, the SOPs presented in this chapter have incorporated several prerequisite steps that (a) ensure effectiveness of the cleaning and sanitizing function and (b) turn the necessary steps into a routine plan that can be accomplished by employees with different skill levels within the time allocated to operate a service seafood department.

Ten different SOPs have been outlined for full-service seafood departments that complete the functions outlined in Chapters 5, 6 and 7. Of those, seven are required each day as part of daily departmental opera-

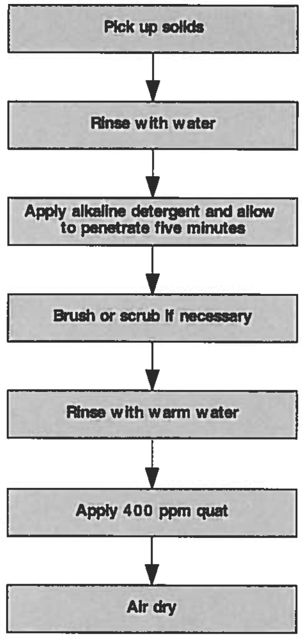

Fig. 8-10. The floor SOP

tions. The two SOPs performed on display equipment are invoked less often. One of these can be invoked three times a week while the other can be done weekly (if pans are not used for all displayed inventory) or far less often (if all displayed merchandise is held in pans descried in Figure 5-10, page 78). Those operations that routinely undertake a significant amount of processing may need to complete the "Floor SOP" each day. Conversely, in those outlets where most handling entails moving products between bulk-packed storage units and the display case, this SOP can be performed fewer times per week.

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